

PB83-910201

SELECTED  
WATER  
RESOURCES  
ABSTRACTS



VOLUME 16, NUMBER 1  
JANUARY 1983

W83-00001 -- W83-00350  
CODEN: SWRABW

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# **SELECTED WATER RESOURCES ABSTRACTS**

A monthly publication of the Geological Survey  
U.S. Department of the Interior

**VOLUME 16, NUMBER 1  
JANUARY 1983**

W83-00001 -- W83-00350



The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

**A**s the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

## PREFACE

**S**elect Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus**. The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific  
Information Center  
U.S. Geological Survey, MS 421  
Reston, VA 22092

# CONTENTS

## SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

### 01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

### 02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

### 03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

### 04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

### 05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

### 06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

### 07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

### 08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

### 09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

### 10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

## SUBJECT INDEX

## AUTHOR INDEX

## ORGANIZATIONAL INDEX

## ACCESSION NUMBER INDEX

# SELECTED WATER RESOURCES ABSTRACTS

## 2. WATER CYCLE

### 2A. General

**STOCHASTIC DAILY PRECIPITATION MODELING AND DAILY STREAMFLOW TRANSFER PROCESSES,**  
Purdue Univ., Lafayette, IN. Water Resources Research Center.  
For primary bibliographic entry see Field 2E.  
W83-00282

**RAINFALL-RUNOFF CHARACTERISTICS FOR A MOUNTAINOUS WATERSHED IN THE NORTHEAST UNITED STATES,**  
Agricultural Research Service, Beltsville, MD. Hydrology Lab.  
E. T. Engman.  
Nordic Hydrology, Vol 12, No 4/5, p 247-264, 1981. 7 Fig, 6 Tab, 16 Ref.

Descriptors: Rainfall-runoff relationships, \*Mountains, \*Watersheds, Hydrologic models, Runoff volume, Regression analysis, Mathematical studies, Storm runoff, Northeastern United States, \*Vermont.

Basic hydrological processes in the mountainous and glaciated upland areas of the northeastern United States are being studied in an instrumented research watershed near Danville, Vermont. One aspect of this investigation is the description of the basic climatic and rainfall-runoff relationships as they apply to mountain hydrology. Rainfall-runoff relationships in this area were found to be characterized by fast response but relatively low runoff volumes, with little evidence of surface runoff. The partial area concept described by Dunne and Black (1970), in which the partial or source areas consist of saturated or near saturated regions adjacent to the stream which are the sources of storm runoff, appears to describe the storm runoff process in these watersheds. The contributing areas for storms in nine watersheds varying from about 0.5 to 112 square kilometers were calculated using a partial area model developed by Lee and Deleur (1976). Regression analysis with several variables showed that the calculated partial areas could be explained to a great degree by the amount of baseflow at the beginning of the storm. These results demonstrated the feasibility of generalizing the partial area representation to large areas. (Carroll-FRC)

W83-00347

### 2B. Precipitation

**THE TOXICOLOGY OF SILVER IODIDE IN RELATION TO ITS USE AS A CLOUD SEEDING AGENT,**  
Department of Water Affairs, Pretoria (South Africa); Hydrological Research Inst., Pretoria (South Africa).  
P. L. Kempster.  
Technical Report No TR 100, September 1979. 14 p, 3 Tab, 29 Ref.

Descriptors: \*Cloud seeding, \*Artificial precipitation, \*Poisons, \*Silver iodide, \*Environmental effects, Silver, Weather modification, Toxicity, Hazardous materials, Heavy metals, Iodides, Iodine, Halogens, Solubility, Surveys, Rainfall, Rainfall area, Local precipitation, Chemistry of precipitation, Precipitation, Feasibility studies.

The potential toxicity resulting from the use of silver iodide (AgI) as a cloud-seeding agent was assessed, relative to knowledge of the reported effects of silver (Ag) and iodine (I) occurring in the environment. The extreme dilution of added AgI in resultant precipitation taken together with its inherent insolubility makes the possibility of poisoning from AgI fallout highly unlikely. It is concluded that there is no danger of either Ag or I toxicity from the use of AgI as a cloud-seeding agent. Nonetheless, a complete accurate record of the total mass of AgI used each year and the total area over which this mass is distributed should be

maintained to assure the attainment of rational decisions with respect to AgI use. The 7 tons of AgI (containing 4 tons of I) released over a 6-year period over an experimental cloud-seeding area is small relative to the several hundred tons of I naturally contained in the 10 sq km ground area of question. Further, an increase in the background level of I would provide a moderate I intake increase that would be beneficial and serve to protect against thyroid disorders. Also, with respect to Ag, insoluble Ag compounds such as AgI have a low toxic potential. (Zielinski-MAXIMA) W83-00084

**THE ANALYSES OF AREAL RAINFALL USING MULTI-QUADRATIC SURFACES,**  
Department of Water Affairs, Pretoria (South Africa). Div. of Hydrology.

P. T. Adamson.  
Technical Report No. 82, September, 1978. 25 p, 7 Fig, 15 Ref, 1 Append.

Descriptors: \*Areal precipitation, \*Computer programs, \*Mathematical studies, \*Terrain analysis, \*Theoretical analysis, Precipitation, Computer models, Model studies, Surface flow, Surface runoff, Topographic mapping, Topography, Rainfall, Mathematical models, Subsurface mapping, Simulation analysis.

The theory, use, and specifications are described for a multi-quadratic surface-fitting computer program. Multi-quadratic analysis offers an analytical approach to the representation of an irregular surface and is appropriate to the application of areal rainfall surfaces. Two examples are provided: one, involving the areal analysis of a 5-day storm; the other, a regional evaluation of annual mean rainfall. The advantage of multi-quadratic analysis is its efficiency, when combined with plotting capability, to produce accurate contour maps objectively and rapidly. The program also is capable of integrating the volume beneath the surface under study while preserving the shape of the study area. Further, while the analytical procedure does not perform well for mountainous areas, dummy coordinates can be introduced provided a suitable relationship between rainfall and altitude is available. In addition, maps can be scaled in such a way that they overlay standard topographical sheets. The multi-quadratic computer program listing and a sample output are provided. Two typical quadratic surfaces consider the use of circular hyperboloids and paraboloids. (Zielinski-MAXIMA) W83-00088

**FACTORS CONTROLLING STABLE ISOTOPES COMPOSITION OF EUROPEAN PRECIPITATION,**  
Heidelberg Univ. (Germany, F.R.). Inst. of Environmental Physics.

K. Rozanski, C. Sonntag, and K. O. Munich. Tellus, Vol 34, No 2, p 142-150, April, 1982. 6 Fig, 24 Ref.

Descriptors: \*Isotope studies, \*Precipitation, \*Isotope fractionation, \*Mathematical models, Simulation analysis, Evapotranspiration, Water vapor, Temperature, Europe.

A simple multibox model of the mean west-east horizontal transport of the atmospheric water vapor across the European continent has been used to simulate the seasonal and spatial variations of stable isotope ratios in present day European precipitation. Isotope fractionation during the formation of precipitation leads to an increasing depletion of heavy isotopes in the residual air moisture as it moves towards the center of the continent. Evapotranspiration compensates for part of this isotope depletion, particularly in summer. Data for the period 1960 through 1980 which were used to develop model estimates include horizontal water vapor flux data and monthly precipitation, evapotranspiration, and surface air temperature data available for various locations in Europe. The model was able to reproduce both continental and seasonal temperature effects observed in the stable-isotope composition of European precipitation fairly well. Regional scale processes, such as water vapor transport patterns into the continent and

average precipitation-evapotranspiration history of air masses precipitating in a given location, were found to be the major contributors to the isotope composition of local precipitation. Local parameters had only a slight influence on the isotope ratios. These model predictions have several implications for the interpretation of stable isotope ratios in earlier periods as preserved in ice cores and in groundwater. (Carroll-FRC) W83-00176

**CLIMATIC ASPECTS OF DROUGHTS,**  
Maryland Univ., College Park. Dept. of Meteorology.

For primary bibliographic entry see Field 3F.  
W83-00188

**A DEPTH-DURATION-FREQUENCY DIAGRAM FOR POINT RAINFALL IN SWA-NAMIBIA,**  
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.

W. V. Pitman.  
Water SA, Vol 6, No 4, p 157-162, October, 1980. 5 Fig, 3 Tab, 4 Ref.

Descriptors: \*Depth-area-duration analysis, \*Weather forecasting, \*Hydraulic structures, \*Data collections, \*Data interpretation, Rainfall intensity, Precipitation intensity, Rainfall-runoff relationships, Rainfall impact, Rainfall, Rainstorms, Prediction, Projections, Hydraulic engineering, Design criteria, Data processing, South Africa, \*Namibia.

Information on extreme rainfall is a basic requirement for the design of hydraulic structures, but no study had been undertaken for hydraulic structure designers for SWA-Namibia, who usually had to rely on doubtful extrapolations from the South African data. Hence, methods were adopted and results obtained in an analysis of extreme one-day point rainfalls in this region. From an analysis of available daily and autographic rainfall data an isohetal map and coaxial diagram were compiled for SWA-Namibia. From the coaxial diagram and map, it was possible to estimate (for a specified recurrence interval) the maximum likely precipitation for any duration between one-tenth of an hour and one day. From this approach, designers can estimate point rainfalls of this duration (6 minutes to 24 hours) with return periods from 2-100 years at any location in SWA-Namibia. Records from 572 daily-read rain gauges were transferred to computer cards. Data from seven official autographic recording stations in, and two outside of, SWA-Namibia were used to disaggregate daily to short-duration rainfall extremes. After appropriate corrections, the data set comprising about 120,000 computer cards was transferred onto magnetic tape for analysis, interpretation, and prediction. (Zielinski-MAXIMA) W83-00289

### 2C. Snow, Ice, and Frost

**FINITE ELEMENT GLACIER DYNAMICS MODEL APPLIED TO COLUMBIA GLACIER, ALASKA,**  
Geological Survey, Tacoma, WA. Water Resources Div.

W. G. Sikkema.  
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, \$5.00. Professional Paper 1258-B, 1982. 74 p, 9 Fig, 2 Tab, 12 Ref, 5 Append.

Descriptors: \*Glaciers, \*Computer models, \*Computer programs, \*Finite element method, \*Continuity equation, Flow, Ice, Viscous flow, Rheology, Boundaries, Moraines, Ice-water interfaces, \*Alaska, Calving, Glacial retreat.

A two-dimensional finite element computer model describes the dynamics of glacier flow, and includes the flow of ice, sliding, calving of the terminus, and surface balance. Surface profile and terminus position are followed in time. A calving law which relates calving speed to water discharge at the bed of the glacier and to the height of the ice

## Field 2—WATER CYCLE

### Group 2C—Snow, Ice, and Frost

column unsupported by water pressure, is shown to fit observed calving at Columbia Glacier. Application of the flow model to Columbia Glacier indicates catastrophic, rapid retreat from the terminal moraine beginning in 1983. (USGS) W83-00118

#### CONTINUITY EQUATION MODEL OF THE PREDICTED DRASIC RETREAT OF COLUMBIA GLACIER, ALASKA,

Geological Survey, Tacoma, WA. Water Resources Div.

L. A. Rasmussen, and M. F. Meier.

Available from Supt. of Documents, GPO, Washington, DC 20402, Price, \$3.50. Professional Paper 1283-A, 1982. 23 p, 22 Fig, 3 Tab, 12 Ref.

Descriptors: \*Glaciers, \*Continuity equation, \*Computer models, \*Glacier mass balance, Prediction, Icebergs, Ablation, Velocity, \*Alaska, \*Columbia Glacier, Calving, Glacier retreat.

A one-dimensional numerical model based on the continuity equation is developed to predict the retreat rate of the terminus of Columbia Glacier, Alaska, and to estimate the time distribution of the iceberg discharge. The retreat of the terminus is expressed in terms of the difference between the glacier flux to the terminus and the iceberg flux from the terminus. The continuity equation is applied to the lower 14 kilometers of the glacier to determine the ice flux to the terminus as the sum of the ice flux into the lower reach of the glacier and the flux increment resulting from the thinning of the lower reach not due to ablation. The iceberg flux is assumed to be proportional to the average water depth at the terminus. All calculations are performed on annualized data. A sequence of longitudinal profiles is supplied; the model then determines the times at which the glacier assumes each of the profiles. The effect on the predicted retreat rate caused by the arbitrariness of the longitudinal profiles appears to be less than the effect of other uncertainties in the data used. The predicted retreat slowly accelerates from the initial observed rate of 45 meters per year until 1983.0 + or - 0.9, when the terminus reaches deep water, and the retreat rate rapidly increases to about 4 kilometers per year. A maximum iceberg calving flux of about 10 cubic kilometers per year, which is 6 to 8 times the initial amount, is expected to occur in about 1983. (USGS) W83-00119

## 2D. Evaporation and Transpiration

#### PINE TREE EVAPOTRANSPIRATION,

Florida Univ., Gainesville. School of Forest Resources and Conservation.

H. Riekerk.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108167, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Florida, Publication No 62, Gainesville, March, 1982. 37 p, 10 Fig, 1 Tab, 80 Ref. 1 Append. OWRT A-039-FLA(1),14-34-0001-9010/0110/1110.

Descriptors: \*Evapotranspiration, Evapotranspiration control, Evapotranspiration potential, \*Pine trees, \*Evaporation rate, \*Seasonal variation, \*Mathematical equations, Lysimeters, Moisture meters, Aeration zone, Mathematical studies, Mathematical models, Correlation analysis, Statistical methods, Stochastic process.

An experimental study was conducted to evaluate the relationship of the Penman equation of potential evaporation (PE) to actual evapotranspiration (ET) data from a developing flatwoods pine plantation. Daily atmospheric demand data from weather station information were compared with daily ET data from a nearby weighing lysimeter installation placed in a young pine plantation. The installation was in poorly-drained soil, and had a sensitivity of about 0.5 mm water. Average seasonal ET was 2.4, 1.2, and 5.7 mm/day for the autumn, winter, and spring months, respectively. Equipment failures produced by high humidity and

lightening damage prevented reliable ET data collection for the summer. The PE was calculated from the Penman equation using the weather station data; total PE was 1440 mm for the year of measurement. Seasonal ratios of measured ET to calculated PE were 0.92, 0.44, and 0.89 for the autumn, winter, and spring months, respectively. Prediction of ET seasonal rates by the Penman method was good for the autumn and spring seasons. Water use during the spring drought lowered the water table below the rooting zone. Soil water drawn by roots from the unsaturated zone rapidly became limiting for slash pine transpiration until summer rains raised the water table again. (Zielinski-MAXIMA) W83-00279

#### A WEIGHING LYSIMETER FACILITY AT RODEEPLAT FOR CROP EVAPOTRANSPIRATION STUDIES,

Soil and Irrigation Research Inst. Pretoria, (South Africa). Dep. of Agricultural Technical Services.

J. L. Hutson, and G. C. Green.

Water SA (Pretoria), Vol 6, No 1, p 41-46, January, 1980. 3 Fig, 1 Tab, 20 Ref.

Descriptors: \*Lysimeters, \*Evapotranspiration potential, \*Design criteria, \*Irrigation practices, \*Crop yield, Moisture meters, Evapotranspiration, Crop production, Consumptive use, Data processing, Soil water, Soil moisture meters, Moisture, Rainfall, Monitoring, Irrigation, Calibrations, \*South Africa.

Design features of four recording lysimeters installed 30 km north of Pretoria are described, each consisting of a 2 m by 2 m by 1 m steel tank supported on a counter-balanced lever system. Water content changes were monitored by means of an electronic load beam. Calibration data indicated that hourly evapotranspiration (ET) can be measured to about 0.1 mm water. ET and other environmental parameters were monitored and recorded by a data-logging system. Two years of continuous operation have shown the lysimeter system to be accurate and reliable. In conjunction with other available monitoring facilities at the test site, the lysimeters should prove valuable tools for enhancing awareness of the interaction between soil, water, and atmosphere. Tests were conducted on a crop rotation of wheat in summer and soya beans in winter. The data obtained from the lysimeters gave hourly average water balance of wheat during the growing season, as well as cumulative ET values for 24 hour periods. Calculated calibration constants for the lysimeter design showed that the response of the lysimeters was linear and stable over time and that resolution of about 2.5 microvolts (0.1 mm water) was feasible. Calibration constants are periodically checked to ensure data quality and reliability. (Zielinski-MAXIMA) W83-00287

#### MEASUREMENT AND MAPPING OF POTENTIAL EVAPOTRANSPIRATION IN A SMALL MOUNTAINOUS WATERSHED,

Strasbourg-1 (France).

G. Najjar, B. Ambroise, and J. L. Mercier.

Nordic Hydrology, Vol 12, No 4/5, p 195-206, 1981. 6 Fig, 10 Ref.

Descriptors: \*Evapotranspiration potential, \*Watersheds, \*Mountains, Measurement techniques, Evapotranspiration, Mapping, Solar radiation.

A method has been developed for measuring and mapping evapotranspiration in any mountainous watershed, where the evapotranspiration pattern is considerably influenced by topographic structure. The method involves the use of Brochet and Gerbier's formula, which is derived from Penman's equation for evapotranspiration, in estimating potential evapotranspiration. The method has been applied to the Ringelbach watershed in the Vosges Mountains of France, where climatologic, hydrologic, and geomorphologic processes and their interactions at watershed level have been studied since 1976. Maps of daily evapotranspiration were calculated with the formula by mapping daily global radiation and the Piche evaporation under

shelter. Maps of daily global radiation were computed for sunny days from horizontally measured global solar radiation, taking into account slopes, aspects, and orographic masks. Small and cheap Piche shelters, specially designed and calibrated, were implanted over the whole watershed, with the Piche evaporation under shelter measured twice daily. Important differences within the watershed were found in daily global radiation, Piche evaporation under shelter, and potential evapotranspiration. The spatial patterns among these three factors were dependent on weather type, topographic structure, and soil surface humidity. The mapping procedure, which is easy to apply, provides a good tool for estimating potential evapotranspiration at different scales of space and time from a few point measurements. Use of the method is topoclimatic and hydrologic studies at watershed level in mountainous areas provides assistance in choosing a climatic station truly representative of the watershed climate, provides reliable information for use in spatially-distributed hydrologic models, and permits good insight into the topographic structure of the watershed. (Carroll-FRC) W83-00346

## 2E. Streamflow and Runoff

#### LOW FLOW OF STREAMS IN FAIRFAX COUNTY, VIRGINIA,

Geological Survey, Fairfax, VA. Water Resources Div.

For primary bibliographic entry see Field 4C.

W83-00062

#### FLOODFLOW CHARACTERISTICS RELATED TO CHANNEL GEOMETRY IN OHIO,

Geological Survey, Columbus, OH. Water Resources Div.

E. E. Webber, and J. W. Roberts.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$4.25 in paper copy, \$3.50 in microfiche. Open-File Report 81-1105, 1981. 28 p, 7 Fig, 3 Tab, 21 Ref.

Descriptors: \*Streamflow, \*Floods, \*Flood flow, \*Flow characteristics, Alluvial channels, Channel morphology, Channel flow, Estimating, Flood frequency, Flood peak, Natural streams, Open channels, Flood recurrence interval, Bankfull stage, Gaging stations, Sites, Geomorphology, Hydrologic data, \*Ohio.

Techniques for estimating magnitude and frequency of flood-peak discharges, based on channel-geometry parameters, are presented as a method for evaluating Ohio floods. Peak discharges for 2-, 5-, 10-, 25-, 50-, and 100-year floods at 160 natural flow gaging stations are correlated with the active-channel stream width at each station. The 160 stations are distributed throughout the State and range from 0.12 to 7,422 square miles in drainage area. Six peak discharge estimating equations were developed, one for each frequency of flooding given above, and the standard errors of estimate range from 42 to 55%. (USGS) W83-00067

#### POTENTIAL FLOOD AND DEBRIS HAZARDS AT COTTONWOOD COVE, LAKE MEAD NATIONAL RECREATION AREA, CLARK COUNTY, NEVADA,

Geological Survey, Carson City, NV. Water Resources Div.

O. Moosburner.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$3.50 in paper copy, \$4.00 in microfiche. Open-File Report 80-1216, 1981. 11 p, 2 Fig, 1 Plate, 1 Tab, 4 Ref.

Descriptors: \*Flash floods, \*Hazards, \*Detritus, \*Recreation, Flood frequency, Dikes, Flood routing, Flood control, Maximum probable flood, Flood damage, Sediments, \*Nevada, Lake Mead National Recreation area, Cottonwood Cove, Lake Mohave.

At Cottonwood Cove, Nevada, most of the existing dikes at the recreation sites are effective in

## WATER CYCLE—Field 2

### Streamflow and Runoff—Group 2E

diverting and routing floodflows, up to and including the 100-year flood, away from people and facilities. The dikes across Ranger Residence Wash and Access Road Wash at the mouth divert floods up to the 50-year recurrence interval away from residential areas. Flow and debris damage in protected areas will be relatively minor for floods including the 100-year flood, whereas damage caused by sediment deposition at the mouths of the washes near Lake Mohave could be significant for floods equal to or less than the 100-year flood. The extreme flood, a flood meteorologically and hydrologically possible but so rare as to preclude a frequency estimate, could cause great damage and possible loss of life. The present dikes would be topped or breached by such flooding. (USGS)  
W83-00070

#### ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1981,

Geological Survey, Helena, MT. Water Resources Div.

R. J. Omang, C. Parrett, and J. A. Hull.  
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$15.75 in paper copy, \$4.50 in microfiche. Open-File Report 82-270, March 1982. 112 p, 2 Fig, 4 Ref.

Descriptors: \*Flood peak, \*Small watersheds, \*Floods, \*Flood frequency, Surface runoff, Crest gages, Streamflow, Flow rates, Hydrologic data, \*Montana, Missouri River basin, Columbia River basin.

Annual peak stage and discharge data have been collected and tabulated for crest-stage gaging sites in Montana. The crest-stage program was begun in July 1955 to investigate the magnitude and frequency of floods from small drainage areas. The program has expanded from 45 crest-stage gaging stations initially to 172 stations maintained in 1981. Data in the report are tabulated for the period of record. (USGS)  
W83-00071

#### THE STATISTICS OF EXTREME VALUES AND THE ANALYSES OF FLOODS IN SOUTH AFRICA,

Department of Water Affairs, Pretoria (South Africa). Div. of Hydrology.

P. T. Adamson.

Append.

Descriptors: \*Theoretical analysis, \*Floods, \*South Africa, \*Statistical methods, \*Flood forecasting, Mathematical studies, Statistical analysis, Statistics, Drainage engineering, Structural engineering, Computer programs, Computer models, Flood recurrence interval, Dam design, Rainfall intensity, Excess rainfall, Spillways, Flood profiles, Flood peak.

An introduction to the theoretical background of extreme-value analysis is presented in a manner that simplifies its understanding and use for practicing engineers. The fundamentals of the theory are described such that can be readily understood by the practicing engineer who desires, for example, to design a dam spillway and would also like to know how the answer was arrived at, its limitations, and what confidence he can apply to it. Certain conclusions are drawn from the different methods applied and from the results for South African data. These conclusions should provide a basis for the scientific study of floods in South Africa. In addition, the description and specifications of a computer program written for the routine analysis of annual flood peaks is provided, along with desk calculation procedures and examples. None of the methods presented require more than a simple calculator and the use of the tables provided. The computer program merely provides and plots the results more rapidly and marginally more accurately than desk calculation by means of iteration and interpolation techniques, in addition to offering additional statistics for the interpretation of results. Although confined to floods, the methodology is readily applicable to rainfall

maxima and, with minor adjustment, to droughts. (Zielinski-MAXIMA)  
W83-00089

#### PERENNIAL-STREAMFLOW CHARACTERISTICS RELATED TO CHANNEL GEOMETRY AND SEDIMENT IN MISSOURI RIVER BASIN,

Geological Survey, Lawrence, KS. Water Resources Div.

For primary bibliographic entry see Field 4D.  
W83-00121

#### STREAMFLOWS AND CHANNELS OF THE GREEN RIVER BASIN, WYOMING,

Geological Survey, Cheyenne, WY. Water Resources Div.

For primary bibliographic entry see Field 4A.  
W83-00122

#### INVESTIGATION OF TRENDS IN FLOODING IN THE TUG FORK BASIN OF KENTUCKY, VIRGINIA, AND WEST VIRGINIA,

Geological Survey, Reston, VA. Water Resources Div.

For primary bibliographic entry see Field 4A.  
W83-00128

#### ASSESSMENT OF THE USEFULNESS OF HYDROLOGIC DATA FOR HYDROPOWER FEASIBILITY ANALYSIS,

Idaho Univ., Moscow. Dept. of Civil Engineering. C. C. Warnick, L. F. Heitz, and J. R. Filler.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108555, Price codes: A04 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute, Completion Report, Idaho University, Moscow, June, 1982. 43 p, 15 Fig, 7 Tab, 9 Ref. W83-0068-IDA(1), 14-34-0001-1114.

Descriptors: \*Hydrologic data, \*Feasibility studies, \*Flow duration, \*Streamflow, \*Computer programs, Assessment, Hydrologic data collections, Hydrologic models, Hydrologic systems, Gaging, Hydraulics, Hydrodynamics, Mathematical studies, Correlation analysis, Drainage basins, Flow measurement, \*Idaho, Clearwater River basin, Salmon River basin.

Methods were examined for extrapolating gaged flow information to ungauged locations, which might improve the capability for flow estimations in examining hydropower potential, and might be useful in hydropower feasibility studies. Such methods have been defined. Parametric flow duration (FD) curves were developed from streamflow data measured for various streams in two large Idaho drainage basins (Clearwater River and Salmon River basins). Comparison studies defined the general limits of curve extrapolation, and indicated the necessary flow data input for making acceptable FD analysis. The economic consequences of using different predicted values of flow duration were demonstrated. Study of FD curves for individual months showed that there is considerable variation in FD curve shape from month to month. Dimensionless FD curves could be used to predict FD, once the monthly average flow data were calculated. Dimensionless flow deviation plots of 12 small gaged streams in Horseshoe watershed (Clearwater River basin) showed a similar pattern of the FD curves, and again showed what wide variation in flow values can be expected for particular exceedance percentages. There is relatively less variation in flow values at the 30% exceedance value. Computer programs were used to assist engineering and economic assessments. (Zielinski-MAXIMA)  
W83-00251

#### IIHR DISTRIBUTED PARAMETER WATER-SHED MODEL,

Iowa Univ., Iowa City. Iowa Inst. of Hydraulic Research.

S. C. Jain, S. Kumar, G. Whelan, and T. E. Croley, II.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108084,

Price codes: A11 in paper copy, A01 in microfiche. Iowa Institute of Hydraulic Research Report No 244, June, 1982. 232 p, 38 Fig, 12 Tab, 6 Append. OWRT B-064-IA(1), 14-34-0001-9072.

Descriptors: \*Watersheds, \*IIHR watershed model, \*Hydrologic models, \*Computer models, \*Parametric hydrology, Model studies, Catchment areas, Catchment basins, Model testing, Flood hydrographs, Flood models, Hyetographs, Infiltration coefficient, Rainfall, Overland flow, Channel flow, Sediment transport, \*Iowa, Ralston Creek.

A model is presented which describes a catchment in fine detail by retaining individual characteristics throughout the watershed, and which includes consideration of overland and channel models of water and sediment flows. Specifically considered is the application of the Soil Conservation Service infiltration model to compute rainfall excess hyetographs, flood modeling, watershed sedimentation modeling, and an application to Ralston Creek. The watershed is divided along tributary divides into subcatchments, which are then divided along steepest slope lines into 'streamtubes' which are further partitioned into planar elements by slope that retain individual characteristics (slope, width, land-use/soil characteristics, rainfall input, etc.). Hence, overland flows begin at the tributary divide and enter the channel at the midpoint of the streamtube (node). Channel routing is then performed from node to node via natural channel shapes on the premise that lateral inflows can be adequately represented by the inflows at the nodes. Overland and channel flows are numerically analyzed. The sediment-continuity equation is solved following the flow computations. The flood model was verified on the 3.01 sq mile Ralston Creek watershed; the sediment model will be tested later. (Zielinski-MAXIMA)  
W83-00269

#### STOCHASTIC DAILY PRECIPITATION MODELING AND DAILY STREAMFLOW TRANSFER PROCESSES,

Purdue Univ. Lafayette, IN. Water Resources Research Center.

T. J. Chang, M. L. Kavvas, and J. W. Delleur.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108191, Price codes: A13 in paper copy, A01 in microfiche. Technical Report No 146, June 1982. 268 p, 90 Fig, 32 Tab, 78 Ref, 3 Append. OWRT B-112-IND(1), 14-34-0001-0219.

Descriptors: \*Precipitation, \*Stochastic process, \*Mathematical studies, \*Floods, \*Drought, \*Daily hydrographs, Rainfall-runoff relationships, Rainfall, Streamflow, Streamflow forecasting, Model studies, Probabilistic process, Correlation analysis, Computer models, Computer programs, Estimating equations.

Research studies were carried out to examine the behavior of floods and droughts, and to provide characteristics of run lengths of wet and dry periods which are used to physically interpret flood and drought properties. This was approached through the modeling of daily hydrological series, with the models applied to several Indiana locations. Two newly-defined stochastic processes are constructed: the binary discrete autoregressive moving average (modeling the wet-dry precipitation sequence) mixed with an exponential distribution to express the precipitation magnitude (B-DARMA-E); and the multi-stage discrete autoregressive moving average process (M-DARMA). Both processes are used to model daily precipitation time series in Indiana. A 3-step procedure (identification, estimation, diagnostic checking) was formulated for modeling by the two processes. Identification, using the autocorrelation function has engineering convenience; estimation, through preservation of the auto-correlations, is suitable for stochastic processes; diagnostic checking, using run length distribution, is shown to statistically efficient. Run length distributions for the two processes are defined and derived. Finally, the transfer discrete autoregressive moving average model (T-DARMA) is conceptually constructed for the daily precipitation-stream-flow transfer process, based on known properties of the B-DARMA-E or

## Field 2—WATER CYCLE

### Group 2E—Streamflow and Runoff

M-DARMA precipitation model. (Zielinski-MAXIMA) W83-00282

### 2F. Groundwater

**THE HYDROTHERMAL SYSTEM IN SOUTHERN GRASS VALLEY, PERSHING COUNTY, NEVADA,**  
Geological Survey, Carson City, NV. Water Resources Div.; and Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W83-00060

**APPLICATIONS OF DIGITAL MODELING FOR EVALUATING THE GROUND-WATER RESOURCES OF THE 2,000-FOOT SAND OF THE BATON ROUGE AREA, LOUISIANA,**  
Geological Survey, Baton Rouge, LA. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W83-00109

**DEEP ARTESIAN AQUIFERS OF SANIBEL AND CAPTIVA ISLANDS, LEE COUNTY, FLORIDA,**  
Geological Survey, Tallahassee, FL. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W83-00114

**SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES—NEW ENGLAND REGION,**  
Geological Survey, Reston, VA. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W83-00120

**DESIGNATION OF PRINCIPAL WATER-SUPPLY AQUIFERS IN MINNESOTA,**  
Geological Survey, St. Paul, MN. Water Resources Div.  
D. G. Adolphson, J. F. Ruhl, and R. J. Wolf.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-215534, Price code: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 81-51, August 1981. 19 p, 9 Fig, 1 Tab, 19 Ref.

Descriptors: \*Groundwater, \*Water quality, \*Aquifers, \*Water supply, Water wells, Water demand, Aquifer characteristics, Dissolved solids, \*Minnesota, Twin Cities basin.

Fourteen aquifers, ranging from Precambrian to Quaternary in age, have been identified as the principal sources of water to wells in Minnesota. Half the municipal population and nearly all the rural population depend on water from these aquifers. Buried and surficial sand and gravel aquifers of Quaternary age occur in nearly all areas of the State. The State's ground water generally contains less than 1,000 milligrams per liter dissolved solids, except in the extreme southwest, northeast, and western areas. Saline water is present at depth throughout the State. Six principal water-quality types are present in the aquifers. Calcium magnesium bicarbonate type water, the most common, is generally present throughout the upper part of the ground-water system. (USGS) W83-00125

**ESTIMATED EFFECTS OF PROJECTED GROUND-WATER WITHDRAWALS ON MOVEMENT OF THE SALTWATER FRONT IN THE FLORIDAN AQUIFER, 1976-2000, WEST-CENTRAL FLORIDA,**  
Geological Survey, Lakewood, CO. Water Resources Div.  
For primary bibliographic entry see Field 4B.  
W83-00130

**GROUNDWATER IN THE INNER BLUE-GRASS KARST REGION, KENTUCKY,**

Kentucky Water Resources Research Inst., Lexington.  
J. Thrailkill, L. E. Spangler, W. M. Hopper, Jr., and J. W. Troester.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108126, Research Report No 136, August, 1982. 136 p, 10 Fig, 4 Tab, 67 Ref, 6 Append. OWRT B-064-KY(1), 14-34-0001-9115.

Descriptors: \*Kentucky, \*Environmental tracers, \*Groundwater basins, \*Groundwater movement, \*Geohydrology, Kentucky Bluegrass Karst Region, Bluegrasses, Groundwater, Tracers, Dye releases, Sink drains, Subsurface water, Aquifers, Groundwater pollution, Limestone, Springs.

The use of water tracing and other techniques served to characterize the hydrogeology of about 12% of the Inner Bluegrass Karst Region (560 sq km) of central Kentucky. Using fluorescent dyes (sorbed on fabric and charcoal detectors), 96 traces (average length, 2.7 km; maximum length, 15 km) resulted in the identification of 38 groundwater basins having areas up to 15 sq km. Subsurface basin flow is in a dendritic conduit system at depth of 30 m or more below the surface; flow in the interbasin areas separating the basins is generally less than 5 m deep. Each groundwater basin discharges at a spring whose average discharge is about 20 liters/second/sq m of basin area. The limestone underlying the region is thin-bedded with shale partings and argillaceous units. Within groundwater basins, sinkhole drains and other conduits have breached the shales, and descend (almost vertically) to a level determined by equilibrium flow in the larger conduits. The general location and flow directions in the groundwater basins are probably determined by potentiometric gradient prior to conduit development, and some basins are localized by regional elements; otherwise, lithologic/structural factors have little influence on subsurface flow. (Zielinski-MAXIMA) W83-00275

### 2G. Water In Soils

**SOIL SURVEY OF THE EXPERIMENTAL CATCHMENTS NEAR BETHLEHEM,**  
Department of Water Affairs, Pretoria (South Africa). Hydrological Research Inst., Pretoria (South Africa).  
For primary bibliographic entry see Field 4D.  
W83-00087

**SOIL MAPS OF MONTANA,**  
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.  
For primary bibliographic entry see Field 7C.  
W83-00237

**ADJUSTMENT OF SOIL LIMITATIONS,**  
Stellenbosch Univ. (South Africa).

J. J. Lambrechts.  
The Deciduous Fruit Grower (Cape Town), Vol 30, No 9, p 330-339, September, 1980. 2 Tab, 4 Ref.

Descriptors: \*Soil properties, \*Soil-water-plant relationships, \*Soil stabilization, \*Soil treatment, \*Drainage, \*Mathematical equations, Soil physical properties, Soil moisture retention, Soil water, Soil texture, Soil water potential, Saline soils, Acidic soils, Alkaline soils, Metals, Soil management, Acidity, Surface drainage, Subsoil drainage, Soil density, \*South Africa.

Adjustment measures taken to eliminate or ameliorate soil limitations are discussed. Primary factors individually considered are: limited usable soil depth, soil wetness, brackish soils, soil texture gradients, soil acidity, and inherent soil density. The associated limitations of these soil limitations for crop cultivation and general corrective measures are described. For soils which have limited usable depth, crops (e.g., pears) tolerant to such a limitation can be selected as an alternative to crops which would require an expensive drainage system with regular maintenance (e.g., peaches). Effective soil depth on slightly/moderately sloping sites can

be increased by topsoil ridging. Excessively wet soils can be improved by use of appropriate drainage improvement. Saline sandy soils can only be corrected by leaching and removal of the salty leaching water; generally, artificial drainage is usually essential for desalination. Sodic-magnesian soils present a greater problem, and calcium application is needed to replace sodium and magnesium. Criss-cross plowing with mixing action is needed for soils having texture gradients. Slaked lime is useful to correct for soil acidity. Two mathematical expressions for calculating soil lime requirements are given. (Zielinski-MAXIMA) W83-00286

### 2H. Lakes

**CONTROL OF LAKE PHOSPHORUS WITH ALUMINUM SULFATE: DOSE DETERMINATION AND APPLICATION TECHNIQUES,**  
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.  
For primary bibliographic entry see Field 5C.  
W83-00006

**MASS BALANCE MODEL ESTIMATION OF PHOSPHORUS CONCENTRATIONS IN RESERVOIRS,**  
Bureau of Reclamation, Denver, CO. Engineering Research Center.  
For primary bibliographic entry see Field 5C.  
W83-00009

**DISTRIBUTION OF DENITRIFYING BACTERIA AND ITS CONTROLLING FACTORS IN FRESHWATER ENVIRONMENTS,**  
Tokyo Metropolitan Univ. (Japan). Dept. of Biology.  
For primary bibliographic entry see Field 5C.  
W83-00018

**A PRINCIPAL COMPONENTS ANALYSIS OF THE PHYTOPLANKTON FROM A POND IN THE PARANA RIVER VALLEY, ARGENTINA,**  
Instituto Nacional de Limnología, Santo Tome (Argentina).  
For primary bibliographic entry see Field 5C.  
W83-00022

**APPLICABILITY OF PHOSPHORUS BUDGET MODELS TO SOUTHERN AFRICAN MAN-MADE LAKES,**  
National Inst. for Water Research, Pretoria (South Africa). Limnology Div.  
For primary bibliographic entry see Field 5C.  
W83-00025

**EXISTENCE OF PHYTOPLANKTON IN SPIRIT LAKE NEAR ACTIVE VOLCANO MT. ST. HELENS, WASHINGTON, U.S.A.: POST-ERUPTION FINDINGS,**  
Army Engineer District, Portland, OR.  
For primary bibliographic entry see Field 5C.  
W83-00026

**SEASONAL VARIATION OF ZOOPLANKTON OF THE VELI LAKE, SOUTH-WEST COAST OF INDIA,**  
Kerala Univ., Trivandrum (India). Dept. of Aquatic Biology and Fisheries.  
M. Arunachalam, O. Divakaran, N. Balakrishnan Nair, and N. K. Balasubramanian.  
Archiv für Hydrobiologie, Vol 93, No 3, p 359-374, February, 1982. 9 Fig, 2 Tab, 15 Ref.

Descriptors: \*Zooplankton, \*Invertebrates, \*Seasonal variation, Veli Lake, \*India, Lakes, Nematodes, Annelids, Monsoons, Crustaceans, Copepods, Oligochaetes, Mollusks, Fish, Tropical regions, Brackish water, Flooding, Water temperature, Salinity, Water properties, Oxygen, Insects.

Veli Lake, a tropical backwater lake on India's southwest coast, has periodic access to the Arabian Sea during monsoonal flooding. The potential of

## Lakes—Group 2H

this water for fisheries and aquaculture was assessed by documenting the seasonal fluctuations in the environment and zooplankton. Temperature, salinity, and oxygen levels were 26.9–32.3°C, 0.2–4.8‰, and 3.3–4.9 mg per liter, respectively. The zooplankton population was a combination of marine, brackish water, and fresh water types, mostly nematodes, annelids, arthropods, mollusks, and fish larvae. Crustaceans were most numerous, with copepods being dominant. Other important components were oligochaetes, insect larvae, and fish larvae. At the station closest to the sea, densities were greatest during the monsoon and post-monsoon periods. At the more inland station, densities were highest premonsoon, late monsoon, and post-monsoon. (Cassar-FRC)  
W83-00027

**PALEOECOLOGICAL STUDIES OF THE RECENT DEVELOPMENT OF THE LAKE VAXJÖSJÖN, IV. INTERPRETATION OF THE EUTROPHICATION PROCESS THROUGH THE ANALYSIS OF SUBFOSSIL CHIRONOMIDS,**

Uppsala Univ. (Sweden). Dept. of Entomology. For primary bibliographic entry see Field 5C.  
W83-00028

**EFFECTS OF THE BURROWING MAYFLY, HEXAGENIA, ON NITROGEN AND SULFUR FRACTIONS IN LAKE SEDIMENT MICRO-COSMS,**

State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse. Dept. of Environmental and Forest Biology.  
For primary bibliographic entry see Field 5C.  
W83-00030

**DISTRIBUTION OF CHIRONOMIDS IN THE LITTORAL ZONE OF LAKE TEXOMA, OKLAHOMA AND TEXAS,**

Oklahoma Univ., Norman. Dept. of Zoology.  
C. C. Vaughn.

Hydrobiologia, Vol 89, No 2, p 177–188, April, 1982. 5 Fig, 3 Tab, 59 Ref.

Descriptors: \*Reservoirs, \*Salinity, \*Midges, \*Littoral zone, Population dynamics, Hydrobiology, Population density, Aquatic populations, Species composition, Species diversity, Particulate matter, Organic matter, Wind, Water temperature, \*Oklahoma, Lake Texoma, \*Texas.

Lake Texoma, a large reservoir in southcentral Oklahoma, was formed by the impoundment of the Washita and Red Rivers. The Red River is greater in salinity than the Washita and forms a complex salinity gradient across the reservoir. During the spring and summer of 1978, chironomid populations were monitored with multi-plate samplers in areas of high, intermediate, and low salinity. The distribution of the 14 genera and at least 22 species of chironomids present was affected by food availability, temperature, salinity and wind direction. Filter feeders were most dense in river-arm stations where levels of particulate organic matter were high, while algal grazers attained their highest densities in the clear intermediate area. As the water temperature and the density of *Glyptotendipes* sp. increased, most genera feeding primarily on particulate organic matter decreased. The confinement of certain species to either the Red River arm or the Washita River arm suggests differences in salinity tolerance by chironomids. (Geiger-FRC)  
W83-00031

**PHYSICOCHEMICAL LIMNOLOGY OF THE TONGUE RIVER RESERVOIR, MONTANA,**

Alaska Univ., Fairbanks. Inst. of Marine Science. S. C. Whalen, S. A. Leath, R. W. Gregory, and J. C. Wright.

Hydrobiologia, Vol 89, No 2, p 161–176, April, 1982. 10 Fig, 6 Tab, 55 Ref.

Descriptors: \*Physicochemical properties, \*Hydrologic regime, \*Nutrients, \*Reservoirs, Heat budget, Phosphorus, Nitrogen, Outlets, Advection, Ions, Limnology, Tongue River, \*Montana.

A one year physicochemical survey was conducted on the Tongue River Reservoir, a mature medium-sized Northern Great Plains reservoir characterized by a deep-water outlet. The only significant inflow was the Tongue River, which supplied 93% of the nutrient inputs, 96% of the major ions and 97% of the water input to the impoundment. Heat advection from inflowing water comprised 17% of the energy gained during the summer heating cycle. Fluvial contributions to the annual nutrient load were 20.2 g/sq m total nitrogen and 3.8 g/sq m total phosphorus. Unusual water movement patterns and the absence of reducing conditions caused 99% of the total nitrogen load to be discharged, while nearly half of the total phosphorus load was retained in the reservoir. (Geiger-FRC)  
W83-00033

**LIMNOLOGICAL INVESTIGATIONS OF A MOUNTAIN SPRING POND IN THE SWISS NATIONAL PARK,**

Zurich Univ. (Switzerland). Hydrobiological-Limnological Station.

K. Walti, and F. Schanz.

Archiv für Hydrobiologie, Vol 92, No 1, p 130–136, August, 1981. 2 Fig, 2 Tab, 8 Ref.

Descriptors: \*Productivity, \*Phytoplankton, \*Bacteria, Ponds, Springs, God dal Fuorn Spring, \*Switzerland, Primary productivity, Algae, Benthic flora, Photosynthesis, Sulfur bacteria, Seasonal variations, Chemical composition, Water temperature, Water properties, Conductivity, Aquatic productivity, Plankton.

The chemistry and biology of God dal Fuorn spring pond were documented in 1977–79. This pond, undisturbed by human influences, is located at an altitude of 1820 m in the Swiss Alps. The 62 sq m pond with 43 cu m volume has a turnover time of 2 hours. The chemical composition and temperature (6.0–10.5°C) were fairly constant throughout the year, suggesting that the water originated deep in the mountain. Nitrogen and total P were extremely low, < 0.1 mg per liter and 0.007–0.50 mg per liter, respectively. Conductivity was 2050–2090 micros per cm; Ca, 540–570 mg per liter; and sulfates, 1420–1470 mg per liter. Bacteria included *Desulfovibrio desulfuricans*, *Beggiaota alba*, *Lamprocystis roseo-persicina*, *Thiocystis violacea*, and *Chromatium okenii*. The planktonic algal population in the open water zone was very low, comprising only a few cells which originated from other habitats (*Mougeotia*, *Spirogyra*, *Zygema*, and some diatoms). *Chara contraria* and *Chara foetida* were the dominant attached algae in the bottom zone. Among the *Chara* and moss vegetation were found *Microspora*, *Oocystis*, *Eremosphaera*, *Cosmarium*, *Spirogyra*, *Mougeotia*, *Microcystis*, *Nostoc*, *Chroococcus*, and *Tribonema*. Of the total primary productivity 75–80% originated due to photosynthesis of shore vegetation; 5–10% photosynthesis of plankton; and 5–10% chemosynthesis of sulfur bacteria. (Cassar-FRC)  
W83-00034

**THE STRUCTURE AND SOME RECENT CHANGES OF THE ZOOBENTHIC COMMUNITY IN THE ERMATINGER BECKEN, A SHALLOW LITTORAL PART OF LAKE CONSTANCE,**

Zululand Univ. (South Africa). Dept. of Botany. P. E. Reavell, and P. Frenzel.

Archiv für Hydrobiologie, Vol 92, No 1, p 44–52, August, 1981. 3 Fig, 2 Tab, 10 Ref.

Descriptors: \*Aquatic plants, \*Benthic fauna, \*Species composition, Macrophytes, Aquatic habitats, Stagnant water, \*Lake Constance, Ermatinger Becken, Littoral zones, Shallow water, Species diversity, Predation, Vegetation effects, Oxygen depletion, Water velocity, \*Eutrophication, Water pollution effects, *Chara*, *Potamogeton*, Littoral environment, Intertidal areas, Water currents, Aeration, Grasses, \*South Africa.

The abundance, distribution, and diversity of zoobenthic species in Ermatinger Becken, Lake Constance, were described. This 4 sq km shallow littoral area is situated at the inflow of the Seerhein

from the Obersee (not eutrophic) into the Untersee (naturally eutrophic). Increasing eutrophication was observed from 1948 to 1968 in the littoral zone. The 3 important habitats contained 110 zoobenthic taxa. The emergent reed swamp contained 86 species, 49 of which were restricted to the habitat. The stagnant area contained 22 species, 3 of them restricted; the current-influenced area, 65 species, 23 restricted. Animals were more abundant in regions with higher current velocities and in the winter-dry area in front of the reed swamp. The great species diversity in the reed swamp occurred because the habitat was suitable for ovipositing and overwintering of air breathing Arthropods on the stems and rhizomes of the vegetation. This region had high organic input from the reed swamp plants and good aeration from the adjacent current. The stagnant area had low species diversity because of occasional oxygen depletion. Faunistic changes since 1948 included disappearance of burrowing mayfly larvae, the amphipod *Gammarus pulex*, the pulmonate gastropod *Lymnaea stagnalis*, and triclad turbellarians. These changes were likely a result of alterations in the plant community as a response to increased eutrophication, the disappearance of *Chara* beds (a necessary habitat structure and protection against predation), and the temporary oxygen deficit caused by a luxuriant *Potamogeton* growth. (Cassar-FRC)  
W83-00036

**INVESTIGATIONS ON THE LAKES OF PERU AND THEIR PHYTOPLANKTON. 6 ADDITIONAL CHEMICAL ANALYSES,**

Kernforschungsanstalt, Jülich (Germany, F.R.). Inst. für Biotechnologie III.

E. Hegewald, and K. H. Runkel.

Archiv für Hydrobiologie, Vol 92, No 1, p 31–43, August, 1981. 3 Fig, 5 Tab, 16 Ref.

Descriptors: \*Cations, \*Chemical composition, \*Phytoplankton, \*Lakes, Water quality, \*Peru, Saline lakes, Algae, Sodium, Calcium, Magnesium, Dissolved solids, Algal growth.

Water samples of 16 lakes in Peru were collected in 1977 to investigate water quality and phytoplankton concentrations. Total salt concentrations of the water decreased from north to south, inversely with annual precipitation. Paracas and Huacachina, both ponds south of Lima, had about 60,000 mg per liter total dissolved solids. Paracas had no detectable algae; Huacachina had a blue-green algal bloom and a red bacterium, *Lamprocystis roseo-persicina*. Two other waters had total dissolved solids of 4749 and 1114 mg per liter. The remainder varied from 55 to 999 mg per liter total dissolved solids. Sodium was the dominant cation in Lake Titicaca, lakes of its drainage area, and coastal desert ponds. Calcium was dominant in most of the lakes. Magnesium was dominant in only 2 lakes, which also had low total dissolved solids levels and no detectable  $\text{Ca}^{2+}$  desmids were the dominant phytoplankton. One lake had no detectable Na. The green alga *Monostroma*, growing in the River Yanamayo and other rivers and in outdoor fertilized containers, enriched most cations (including heavy metals) from 1000 to 10,000 times. (Cassar-FRC)  
W83-00037

**METAL BINDING CAPACITY IN RELATION TO HYDROLOGY AND ALgal PERIODICITY IN TJEUKEMEER, THE NETHERLANDS,**

Limnological Inst., Oosterzee (Netherlands). Tjeukemeer Lab.

For primary bibliographic entry see Field 5B.  
W83-00039

**NITROGEN METABOLISM IN LAKE KIZAKI, JAPAN. III. ACTIVE NITRIFICATION IN EARLY SUMMER,**

Nagoya Univ. (Japan). Water Research Inst.

M. Takahashi, T. Yoshioka, and Y. Saito.

Archiv für Hydrobiologie, Vol 93, No 3, p 272–286, February, 1982. 5 Fig, 5 Tab, 25 Ref.

Descriptors: \*Nitrification, \*Bacteria, \*Ammonium, \*Nitrates, Lakes, Lake Kizaki, \*Japan, Nitrites, Bacteria, Hypolimnion, Kinetics, Oxidation,

## Field 2—WATER CYCLE

### Group 2H—Lakes

Water temperature, Dissolved oxygen, Particulate matter, Seasonal variation, Thermal stratification.

Nitrification was active in the hypolimnion (10-20 m depth) of Lake Kizaki, Japan, in late June-early July 1977 and 1979. The oxidation of ammonium began at the 18-20 m depth and moved upwards. The maximum daily increase of nitrate was 1.5 microgram atoms per liter day at 20 m depth, or 7% of total inorganic nitrogen at this depth. No nitrite accumulation was observed. By the middle of July almost all ammonium above 20 m had been oxidized to nitrate. During the nitrification period the potential rates of ammonium and nitrite oxidation increased simultaneously about 2 orders of magnitude over rates in the period of nonactive nitrification, and the potential nitrite oxidation rates were always greater than those of ammonium. The counts of ammonium and nitrite oxidizing bacteria were fairly uniform from May to August. The bacterial number fluctuations did not correspond with the nitrification process, nor did water temperature or dissolved oxygen. Possible reasons for the active nitrification are interaction of nitrifying bacteria with heterotrophic bacteria or particulate matter. (Cassar-FRC)  
W83-00044

**PHYTOPLANKTON CONTRIBUTION TO ALKALINE PHOSPHATASE ACTIVITY,**  
Oak Ridge National Lab., TN. Environmental Sciences Div.  
A. J. Stewart, and R. G. Wetzel.  
Archiv fur Hydrobiologie, Vol. 93, No. 3, p 265-271, February, 1982. 1 Fig, 2 Tab, 19 Ref.

Descriptors: \*Algae, \*Bacteria, \*Enzymes, Phytoplankton, \*Phosphatase, Centrifugation, \*Michigan, Filtration, Carbon, Lakes, Lawrence Lake, Lebere Lake, Little Mill, Gull Lake.

The extent to which the presence of non-algal particulate alkaline phosphatase activity (APA) in water samples may bias estimates of algal APA was examined. APA and assimilated carbon in phytoplankton from 4 Michigan lakes was partitioned by centrifugation. In all cases the assimilated carbon partitioned nearly quantitatively (mean partition coefficient value, 8.81 + or - 0.10); APA did not partition quantitatively (partition values, 0.83-5.20 with a mean of 2.53 + or - 0.49). The APA contributions from algae were 5-43%; from nonalgal particulates, 7-73%; and from dissolved enzyme, 14-61%. These results indicate that the quantity of APA directly associated with algal cells may be seriously overestimated by filtration techniques. Some of the APA attributed to the dissolved state may actually be affiliated with extremely small free-living bacteria which pass through the filters. (Cassar-FRC)  
W83-00041

**LITTORAL AND PROFUNDAL MACROINVERTEBRATE COMMUNITIES OF A COASTAL BROWN-WATER LAKE,**  
Virginia Commonwealth Univ., Richmond. Dept. of Biology.  
L. A. Smock, D. L. Stoneburner, and D. R. Lenat.  
Archiv fur Hydrobiologie, Vol. 92, No. 3, p 306-320, October, 1981. 2 Fig, 2 Tab, 21 Ref.

Descriptors: \*Invertebrates, Sediments, \*Benthic fauna, \*Macroinvertebrates, Species composition, Seasonal variation, Lakes, Lake Whitney, \*Georgia, \*Littoral zone, Water level fluctuations, \*Lake sediments.

Lake Whitney, on a barrier island off the Georgia coast, contained 128 macroinvertebrate taxa, as determined over a one-year sampling period. The lake is steep-sided, with two-thirds of its shoreline abutting a *Spartina-Juncus* marsh. The remaining shoreline consists of sand flats and an active, unvegetated dune ridge. There is no visible surface drainage into or out of the lake, and thus the water level is dependent mainly on fluctuations in precipitation and evaporation-transpiration. Fauna were collected from 3 areas in the acidic, brown water lake. Annual mean densities (in individuals per sq m) were: profundal sediments, 702, with little seasonal variation, dominant species, the chironomid *Coelotanypus tricolor*; deep littoral macrophyte zone, 4013, dominant species, the amphipod *Crangonyx* spp.; shallow littoral macrophyte zone, 6519, dominant species, *Caenid minima*; and shallow littoral sediments, 12,256, dominant species *Crangonyx* spp. The littoral macroinvertebrate densities fluctuated widely during the year, depending on quality and quantity of food resources and changes in water level. (Cassar-FRC)

W83-00044

**THE SEDIMENTS OF THE NEW ARTIFICIAL LAKE BOSTALSEE (SAARLAND, GERMANY), WITH PARTICULAR REFERENCE TO MICROBIAL ACTIVITY,**

Universität des Saarlandes, Saarbrücken (Germany, F.R.). Dept. of Microbiology.

For primary bibliographic entry see Field 5C.

W83-00048

**DIEL PERIODICITY IN THE CHEMICAL COMPOSITION OF LAKE PHYTOPLANKTON,**

University of Science and Technology, Kumasi (Ghana). Dept. of Biological Sciences.

For primary bibliographic entry see Field 5B.

W83-00049

**CHARACTERIZATION OF ACID PHOSPHATASES IN THE ACIDIFIED LAKE GARDJON, SWEDEN,**

Uppsala Univ. (Sweden). Inst. Limnology.

For primary bibliographic entry see Field 5C.

W83-00050

**SEASONAL ABUNDANCE OF CERATIUM HIRUNDINELLA, (O.F. MULLER) SCHRANK IN LAKES OF DIFFERENT TROPHY,**

Alberta Environmental Center, Vegreville.

For primary bibliographic entry see Field 5C.

W83-00052

**AN INTEGRATED STUDY ON LITTORAL AND PELAGIC PRIMARY PRODUCTION IN A SOUTHERN AFRICAN COASTAL LAKE,**

Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.

For primary bibliographic entry see Field 5C.

W83-00053

**THE DEVELOPMENT OF ATTENUANCE DEPTH-PROFILING TO FOLLOW THE CHANGING DISTRIBUTION OF PHYTOPLANKTON AND OTHER PARTICULATE MATERIAL IN A PRODUCTIVE ENGLISH LAKE,**

Freshwater Biological Association, Ambleside (England).

For primary bibliographic entry see Field 5C.

W83-00055

**SPECIES COMPOSITION AND DISTRIBUTION OF ZOOPLANKTON IN A TROPICAL LAKE, LAKE NAIVASHA, KENYA,**

Nairobi Univ. (Kenya). Dept. of Zoology.

For primary bibliographic entry see Field 5B.

W83-00056

**IN SITU RESPONSE OF PHYTOPLANKTON FLUORESCENCE TO RAPID VARIATIONS IN LIGHT,**

Institute of Ocean Sciences, Sidney (Australia).

For primary bibliographic entry see Field 5C.

W83-00141

**DYNAMICS OF PHYTOPLANKTON IN FINNISH LAKES,**

Mai and Tor Nessling Foundation, Helsinki (Finland).

For primary bibliographic entry see Field 5C.

W83-00153

**THE AEROBIC MINERALIZATION OF AMINO ACIDS IN THE SALINE LAKE GRE-**

**VELINGEN AND THE FRESHWATER HARINGVLIET BASIN (THE NETHERLANDS),**  
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).

For primary bibliographic entry see Field 5C.

W83-00178

**EXCRETION AND DOC UTILIZATION BY OSCILLATORIA RUBESCENS D.C. AND ITS ACCOMPANYING MICRO-ORGANISMS,**  
Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene.

For primary bibliographic entry see Field 5C.

W83-00183

**COMPONENTS CONTRIBUTING TO LIGHT EXTINCTION IN NATURAL WATER: METHOD OF ISOLATION,**  
Southern Illinois Univ. at Carbondale. Dept. of Botany.

For primary bibliographic entry see Field 5A.

W83-00213

**PALEOLIMNOLOGY OF LAKE ISLE, ALBERTA, CANADA (INCLUDING SEDIMENT CHEMISTRY, PIGMENTS AND DIATOM STRATIGRAPHY),**

Alberta Univ., Edmonton. Dept. of Botany.

M. Hickman, and D. M. Klarer.

Archiv fur Hydrobiologie, Vol 91, No 4, p 490-508, July, 1981. 14 Fig, 2 Tab, 37 Ref.

Descriptors: \*Paleolimnology, \*Lake sediments, \*Species composition, Sedimentology, Diatoms, Plankton, Paleoclimatology, Stratification, Benthic fauna, Minerals, Calcium, Iron, Eutrophic lakes, Species diversity, Carbonates, Eutrophication, Stratigraphy, Productivity, Volcanoes, \*Alberta, Canada, Lake Isle.

The paleolimnology of Lake Isle, a shallow eutrophic lake typical of central Alberta, Canada, was studied through examination of a sediment core, using chemistry, pigments and diatom stratigraphy. Calcium, iron, and carbonate fluctuations revealed that during the warm, dry hypothermal stage, the lake became more shallow. During this period, the lake was the most productive, displaying diatom stratigraphy. Initially, benthic species (mainly *Fragilaria* spp.) dominated but were quickly replaced by planktonic species (*Stephanodiscus hantzschii*, *S. astraea*, *Cyclotella comta* and *Tabellaria fenestrata*). After the volcanic ash from Mount Mazama disrupted the natural aging process, the benthic species again predominated (epipelic species). During the post-hypothermal period, little change was noted. (Geiger-FRC)  
W83-00316

**STRATIGRAPHIC DIATOM AND CHEMICAL EVIDENCE FOR ACID STRIP-MINE LAKE RECOVERY,**

Kent State Univ., OH. Dept. of Biological Sciences.

S. C. Fritz, and R. E. Carlson.

Water, Air, and Soil Pollution, Vol 17, No 2, p 151-163, 1982. 7 Fig, 28 Ref.

Descriptors: \*Acid mine drainage, \*Lake restoration, Diatoms, Lake sediments, Sediment-water interfaces, Chemical properties, Chemical composition, Population dynamics, \*Ohio.

Although much is known about the ecological problems associated with the pollution of surface waters by acid mine drainage and other types of acidic inputs, little is known about the recovery pattern of acidified systems. Paleolimnological techniques were used to study the development of a 60-year-old acid strip mine lake in southern Ohio. These techniques provide a continuous record of changes in both chemical deposition and aspects of the biological community. Stratigraphic analyses of chemical compounds in a sediment core from the lake indicate that chemical recovery of the lake, defined as the rise and maintenance of water pH at values above 4.5, is a discrete process marked in the core by a sharp rise in the sediment concentrations of metals. Stratigraphic analyses of

## Erosion and Sedimentation—Group 2J

diatoms in the sediment core suggest that biological recovery may occur in stages, beginning at the sediment-water interface. An early period in which the diatom community was composed of very few species and was dominated by a single acidophilous species was followed by an expansion of the benthic flora and a gradual colonization by many planktonic, epiphytic, and benthic species of primarily alkaliphilous preference. The diatom data indicate that biological development is directly correlated with the apparent shift in pH in terms of the total number of diatom individuals per cubic centimeter and of an increase in the percent of planktonic individuals. However, this biological recovery is not contingent upon complete chemical recovery. (Carroll-FRC)  
W83-00329

**NITROGEN METABOLISM IN LAKE KIZAKI, JAPAN I. AMMONIUM AND NITRATE UPTAKE BY PHYTOPLANKTON,**  
Nagoya Univ. (Japan). Water Research Inst.  
M. Takahashi, and Y. Saito.  
Archiv für Hydrobiologie, Vol 91, No 4, p 393-407, July, 1981. 6 Fig, 29 Ref.

Descriptors: \*Phytoplankton, \*Mesotrophic lakes, \*Nitrates, \*Ammonium, \*Absorption, Mesotrophy, Nitrogen, Irradiation, Water temperature, Euphotic zone, Tracers, Light penetration, Light intensity, Seasonal variation, \*Japan, \*Lake Kizaki.

The ammonium and nitrate uptake rates of phytoplankton in the small mesotrophic Japanese lake, Lake Kizaki, were measured fourteen times from April to October of 1977 by the nitrogen 15 technique. Lake Kizaki is a mesotrophic lake in central Japan with a surface area of 1.4 sq km and maximum depth of 29 m. A thermocline was established from 7 to 11 m depth in early May, and persisted until the end of autumn. Nitrogen uptake experiments were carried out at the same station almost every two weeks. Nitrate uptake was predominant during spring to early summer, while ammonium uptake was more prevalent during mid-summer to autumn. At high light levels in the presence of ammonium, even at concentrations as low as 0.5 micrograms/liter, nitrate uptake was repressed. Phytoplankton displayed a preference for ammonium uptake throughout the study period. In the lower portion of the euphotic zone, nitrogen uptake was affected more by irradiance than by ammonium concentration or water temperature. (Geiger-FRC)  
W83-00344

**NITROGEN METABOLISM IN LAKE KIZAKI, JAPAN II. DISTRIBUTION AND DECOMPOSITION OF ORGANIC NITROGEN,**  
Nagoya Univ. (Japan). Water Research Inst.  
M. Takahashi, and Y. Saito.  
Archiv für Hydrobiologie, Vol 92, No 3, p 359-376, October, 1981. 7 Fig, 3 Tab, 31 Ref.

Descriptors: \*Nitrogen compounds, \*Particulate matter, \*Decomposition, Organic nitrogen, \*Lake Kizaki, \*Japan, Lakes, Organic matter, Nitrates, Seasonal variation, Vertical distribution, Hypolimnion, Thermal stratification.

Seasonal variations in particulate organic nitrogen (PON) and dissolved organic nitrogen (DON) were measured biweekly from April to October 1977 in Lake Kizaki, Japan. On April 5 the vertical distributions of PON and DON were uniform, 3.8 and 4.8 microgram-atom N per liter, respectively. After thermal stratification PON and DON in the euphotic layer (5-8 m, depending on season) increased to a maximum and then decreased. The maxima were 17.5 microgram-atom N per liter PON in July and 12.4 microgram-atom N per liter DON in August. In midsummer PON reached a maximum of 30 microgram-atom N per liter at a depth of 5 m. Below 10 m average concentrations of PON and DON were uniform with depth and time from July to October, 1.7 and 3.8 microgram atom N per liter, respectively. A one-dimensional diffusion-advection model applied to PON showed that the in situ rate of PON decomposition in the metalimnion was first-order, with a rate constant of 0.086 per day in the 6-8 m deep layer from July 13

to August 9. A one box model determined that the ratio of nitrate production (decomposition rate of organic N) in the hypolimnion (10-20 m depth) was 0.064 microgram-atom N per liter per day. The decrease in organic nitrogen corresponding to the increase of nitrate was not found in the distribution of PON or DON. Results suggested that the source of decomposition in the metalimnion was distributed particulate organic matter, whereas in the hypolimnion it was the sediment trap flux of particulate organic matter. (Cassar-FRC)  
W83-00345

## 2I. Water In Plants

**SEASONAL PROGRESSIONS IN THE WATER RELATIONS OF DECIDUOUS AND EVERGREEN PERENNIALS IN THE NORTHERN CALIFORNIA CHAPARRAL,**  
California Univ., Davis. Dept. of Botany.  
H. W. Calkin, and R. W. Pearcy.

In Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California. Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982. p 591, 1 Tab, 1 Fig, 2 Ref.

Descriptors: \*Chaparral, \*Plant water potentials, \*Osmotic pressure, \*Stomatal transpiration, Seasonal variation, Adaptation, Diurnal distribution, Leaves, Turgidity, \*California.

A pressure bomb and null balance diffusion porometer were used to follow the seasonal progression of osmotic adjustment and stomatal reactivity in the following chaparral perennials in the Vaca hills of northern California: toyon (*Heteromeles arbutifolia*), redbud (*Cercis occidentalis*), and buckeye (*Aesculus californica*). In general, as the dry season progressed, stomatal opening became more restricted to morning hours, and the magnitudes of the morning peak and mid-day plateau decreased. Leaf water potentials became more negative and for *Heteromeles* and *Cercis* reached values near their turgor loss point. *Aesculus* leaves maintained turgor pressures of at least .5 MPa all season. The seasonal drop in osmotic potentials and plant water potentials was greatest in *Heteromeles*, intermediate in *Cercis* and least in *Aesculus*. In *Heteromeles* and *Cercis* both stomatal and osmotic adjustments contribute to the buffering of cell volume and turgor. Osmotic adjustment played the role in *Aesculus*. (Moore-SRC)  
W83-00307

## 2J. Erosion and Sedimentation

**RELATION OF USLE FACTORS TO EROSION ON RANGELAND,**  
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.  
G. R. Foster.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 17-35, 3 Fig, 2 Tab, 31 Ref.

Descriptors: \*Rangeland, \*Soil erosion, \*Runoff, \*Erosion control, Climate, Soil properties, Topography, Land use, Rainfall, Slopes, Soil conservation, Range management.

Factors in the Universal Soil-Loss Equation (USLE) are measures of the effect of climate, soil, topography, and land use on erosion. The factors are referenced to a unit plot, 72.6 ft long on 9% slope, maintained in tilled, continuous fallow. The USLE is primarily used to inventory erosion under current conditions and to guide the selection of practices to control erosion to a tolerable level. It has been widely applied to cropland in the Eastern U.S. and recently has been extended to Western rangeland. Special considerations are required in this new application because rangeland conditions differ significantly from those used to derive the USLE. The USLE factors are  $A = R K L S C P$ , where  $A$  = soil loss,  $R$  = rainfall-runoff erosivity factor,  $K$  = soil erodibility factor,  $L$  = slope length

factor,  $S$  = slope steepness factor,  $C$  = cover and management factor, and  $P$  = supporting conservation practice factor. The infrequency of rainfall and its great spatial variability in the West are considerations in application of the USLE. Many rangeland slopes exceed 20% or 25%, the upper limit of the data used to develop the  $S$  factor. Using present equations for  $S$ , the soil loss from steep slopes may be over-estimated. The  $C$  factor is often the most important factor. At the site, it is the only factor that a range manager may easily change to control erosion. (Moore-SRC)  
W83-00096

**USE OF EROSION MODELS ON WESTERN RANGELANDS,**  
Bureau of Land Management, Boise, ID.  
K. A. Gebhardt.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 39-46, 1 Fig, 3 Tab, 11 Ref.

Descriptors: \*Soil erosion, \*Rangeland, \*Grazing, \*Mathematical models, Vegetation, Environmental Impact Statement, Range management, Sediment yield, Resources management.

Soil loss and sediment yield equations have received greater use on western rangelands in recent years largely because of the emphasis on quantitative impact analysis. The available soil loss equations have been used in many grazing Environmental Impact Statements (EIS) to estimate existing soil loss and to predict soil loss due to changes in vegetative cover, but managers may place too much validity on the estimates when the differences are too small to be considered significant. Limitations of the soil loss estimates should be explained to avoid misuse in application. Universal Soil Loss Equation (USLE) estimates are generally most accurate with slope lengths of less than 400 ft and slopes from 3 to 18% having consistent cropping and management systems. Since the USLE is empirically derived, these limitations do not favor wide application to rangeland without extensive field validation. Rangeland limitations of soil loss equations can be quite extensive. Application of available erosion methodologies must be geared toward solving problems associated with resource use. The erosion model must be designed for the needed application and be sensitive to changes in manageable characteristics (those which can be affected by management actions). (Moore-SRC)  
W83-00097

**THE USLE RAINFALL FACTOR FOR SOUTHWESTERN U. S. RANGELANDS,**  
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.  
For primary bibliographic entry see Field 4D.  
W83-00098

**EFFECTS OF SLOPE LENGTH AND STEEPNESS ON SOIL EROSION FROM RANGELANDS,**  
Washington State Univ., Pullman.  
D. K. McCool.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 73-95, 1 Fig, 1 Tab, 34 Ref.

Descriptors: \*Slopes, \*Rangeland, \*Soil erosion, \*Rainfall rate, \*Runoff, Mathematical models, Rill erosion, Rainfall simulators.

Data on the effect of slope length and steepness on soil loss from rangelands are virtually nonexistent. If accurate predictions of soil loss from rangelands are needed for range resource maintenance or water quality purposes, a program of data collection will be needed. The most rapid means of collecting this data will be with rainfall simulators larger than those previously used. In the interim, it is suggested that rangelands be classified as Category I (no observed or expected rill erosion under

## Field 2—WATER CYCLE

### Group 2J—Erosion and Sedimentation

large rates and volumes of rainfall and runoff, Category II (moderate rainfall and runoff rate and moderate rilling observed or expected), and Category III (rill erosion expected from high rainfall and runoff rates). Equations were developed for predicting the influence of slope length and steepness on erosion. Because there is little data to support the relationships in these equations, and because of the wide range of values for slope steepness factor at slopes above 20% calculated from them, the equations are offered for field use on a trial basis and to elicit response from resource management personnel and researchers. (Moore-SRC)

W83-00099

#### SPECIAL PROBLEMS IN THE APPLICATION OF THE USLE TO RANGELANDS: C AND P FACTORS,

Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.

G. R. Foster.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 96-100, 4 Ref.

Descriptors: \*Rangelands, \*Soil erosion, \*Mathematical models, \*Range management, Runoff, Land management, Vegetation.

The Universal Soil Loss Equation (USLE) is being used to estimate erosion on rangeland in the Western United States. This is a new application of the USLE, and values for the cover-management factor C and the supporting practice factor P are being used that were derived from data principally obtained from Eastern U. S. cropland soils and covers. Consequently, research is needed to validate the currently used C and P values and to develop new values where necessary. Development of C and P values for Western rangeland will need to include identification of the influential factors affecting erosion on rangeland, and evaluation of the effects of erosion pavement, cover, nonuniformity of cover, roughness, soil disturbance, roots, freezing and thawing, burning, frequent and intense storms, and ridges, pitting and other mechanical treatments on runoff and erosion. (Author's abstract)

W83-00100

#### A TEST OF THE USLE ON BARE AND SAGE-BRUSH PLOTS IN UTAH,

Utah State Univ., Logan. Watershed Science Unit. For primary bibliographic entry see Field 4D. W83-00101

#### USE OF RAINFALL SIMULATORS TO DETERMINE PARAMETERS FOR EROSION PREDICTION,

Science and Education Administration, Ames, IA. J. M. Laflen.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 106-114, 36 Ref.

Descriptors: \*Rainfall simulators, \*Soil erosion, \*Agriculture, \*Model studies, Storms, Rainfall intensity, Mathematical models, Runoff.

Rainfall simulators are necessary to determine Universal Soil Loss Equation (USLE) parameters because of rapid changes in agricultural practices. The rainfall simulator has been used extensively to collect soil erodibility data. Plot preparation in nearly all studies has consisted of removing vegetation and tillage. Rainfall simulator storms have been similar, but storm sequences have varied somewhat. The rainfall simulator has also been used extensively to study the effect of cropping and tillage on soil erosion. A large number of the studies have been performed by using a common storm arrangement of a 60-minute storm, followed about 24 hours later by two 30-minute storms separated by a 15-minute period, all at an intensity of 6.4 cm/hr. Cropping management factors have

not been directly computed from rainfall simulation results. Values are generally relative to a treatment having a known c-value. Studies should be designed and conducted to gain data for mathematical models describing the erosion process. Length simulation during rainfall simulation has been found to be highly useful. (Moore-SRC)

W83-00102

#### ESTIMATING SEDIMENT YIELD FROM RANGELAND WITH CREAMS,

Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.

G. R. Foster, and L. J. Lane.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 115-119, 14 Ref.

Descriptors: \*Rangelands, \*CREAMS, \*Soil erosion, \*Sediment yield, \*Mathematical models, Slopes, Deposition, Backwater, Sediment transport, Storms, Rainfall-runoff relationships, Agriculture.

The erosion/sediment yield component of CREAMS, a field-scale model for Chemicals, Runoff, and Erosion from Agricultural Management Systems, may be used to estimate sediment yield from small rangeland watersheds. The component operates on a storm-by-storm basis using rainfall erosivity, runoff volume, and a characteristic runoff rate. The erosion/sediment yield component of CREAMS was originally developed for agricultural fields but has sufficient generality to apply to rangelands, disturbed forest areas, construction sites, and surface mines. The component also applies to a broad range of conservation practices including conservation tillage, rotations, contouring, strip-cropping, terraces, grassed waterways, and small impoundments. It considers the influence of topographic features on erosion and deposition along concave, convex, and complex slopes; deposition by backwater at field outlets; and erosion and deposition in natural and constructed waterways. The model has overland flow, concentrated flow, and impoundment components to represent the major hydrologic, hydraulic, erosion, deposition, and sediment transport processes on field-sized areas. Validation studies have shown that the model gives reasonable results for agricultural areas with little or no calibration. (Moore-SRC)

W83-00103

#### MODELING EROSION IN OVERLAND FLOW,

Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.

For primary bibliographic entry see Field 4D. W83-00104

#### SEDIMENT YIELD FROM SMALL SEMIARID RANGELAND WATERSHEDS,

Science and Education Administration, Tucson, AZ.

For primary bibliographic entry see Field 4D. W83-00105

#### PREDICTING SEDIMENT YIELDS FROM SAGEBRUSH RANGELANDS,

Science and Education Administration, Boise, ID. Northwest Watershed Research Center.

For primary bibliographic entry see Field 4D. W83-00106

#### TESTING THE MODIFIED UNIVERSAL SOIL LOSS EQUATION,

Agricultural Research Service, Temple, TX. For primary bibliographic entry see Field 4D. W83-00107

#### DEVELOPING A USLE COVER-MANAGEMENT (C) FACTOR PROCEDURE FOR FOREST CONDITIONS,

Forest Service, Atlanta, GA.

For primary bibliographic entry see Field 4D. W83-00108

#### THE SPATIAL DISTRIBUTION IN SOUTHERN AFRICA OF RAINFALL EROSION FOR USE IN THE UNIVERSAL SOIL LOSS EQUATION,

Department of Agriculture and Fisheries, Pietermaritzburg (South Africa).

A. A. Smithen, and R. E. Schulze.

Water SA, Vol 8, No 2, p 74-78, April, 1982. 3 Fig, 1 Tab, 9 Ref.

Descriptors: \*Erosion rates, \*Rainfall intensity, \*Kinetic energy, \*Soil erosion, \*South Africa, Universal Soil Loss Equation, Spatial distribution, Distribution.

Rainfall erosivity parameters are essential in soil loss modeling. Rainfall erosivity is a climatic factor which can only be determined from local rainfall data. The rainfall erosivity factor, EI30, a factor used in the Universal Soil Loss Equation (USLE), is the product of the kinetic energy of falling rain (E) and its maximum 30 min intensity (I30). Design values of EI30 for South Africa are derived from 4 parameters based on daily rainfall values: total rainfall, effective rainfall, modified Fournier's index, and burst factor. The estimated long-term average annual EI30 values are plotted on a map and lines of equal rainfall erosivity drawn. This permits estimating the EI30 for any location in South Africa and the R factor of the USLE. Another map shows annual values of rainfall erosivity for a 25-year return period. (Cassar-FRC)

W83-00140

#### EROSION AND SEDIMENTATION AS PART OF THE NATURAL SYSTEM,

California State Univ., Northridge. Dept. of Geography.

R. B. Howard.

In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982. p 403-408, 28 Ref.

Descriptors: \*Chaparral, \*Soil erosion, \*Sedimentation rates, \*Precipitation, \*California, Runoff, Fires, Climate, Orographic precipitation, Water repellent soils, Slopes, Seasonal distribution.

There are two basic classes of processes responsible for earth surface morphology: endogenic and exogenic processes. The exogenic processes are controlled largely by atmospheric agencies, and can be divided into denudation and deposition. Denudation involves both weathering as well as erosion. In southern California the denudational environments coincide with the bedrock of the mountain fronts; this also tends to be the environment of the chaparral. Climatically, the chaparral environment displays a strongly seasonal precipitation pattern which is characteristic of the Mediterranean climate. Superimposed on this seasonal regime is the orographic influence on the spatial distribution of precipitation. Given the physical conditions of California's chaparral watersheds, it is surprising that they do not yield an even greater amount of sediment under normal conditions. Fire is also a major environmental agent in shaping California's chaparral. After fire, runoff and sediment yield increase well above normal. This is probably due in part to the development of a hydrophobic layer below the soil's surface. In the chaparral environment of Southern California with its tectonically active mountain masses, high relief, steep slopes and strongly seasonal precipitation, large normal sediment yields are to be expected. Increased sediment yields of up to 30 times normal are also natural in this environment because of fire, approaching thresholds and the variable, seasonal precipitation. (Moore-SRC)

W83-00305

## WATER CYCLE—Field 2

### Estuaries—Group 2L

#### 2K. Chemical Processes

**SELECTED HYDROGEOLOGIC DATA FROM SOUTHERN SWEET GRASS COUNTY, SOUTH-CENTRAL MONTANA.**  
Geological Survey, Helena, MT. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W83-00076

**CHEMICAL AND ISOTOPIC COMPOSITION OF WATER FROM THERMAL AND MINERAL SPRINGS OF WASHINGTON,**  
Geological Survey, Menlo Park, CA. Water Resources Div.

R. H. Mariner, T. S. Presser, and W. C. Evans.  
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225, Price: \$2.50 in paper copy, \$3.50 in microfiche. Open-File Report 82-98, February 1982, 18 p, 2 Fig, 5 Tab, 26 Ref.

Descriptors: \*Chemical analysis, \*Stable isotopes, \*Thermal springs, \*Mineral springs, Thermal water, Geothermal studies, Chemical composition, Sampling, \*Washington, Geothermometry.

Water from thermal springs of Washington range in chemical composition from dilute NaHCO<sub>3</sub>, to moderately saline CO<sub>2</sub>-charged NaHCO<sub>3</sub>-Cl waters. St. Martin's Hot Spring which discharges a slightly saline NaCl water, is the notable exception. Mineral springs generally discharge a moderately saline CO<sub>2</sub>-charged NaHCO<sub>3</sub>-Cl water. The dilute Na-HCO<sub>3</sub> waters are generally associated with granite. The warm to hot waters charged with CO<sub>2</sub> issue on or near the large stratovolcanoes and many of the mineral springs also occur near the large volcanoes. The dilute waters have oxygen isotopic compositions which indicate relatively little water-rock exchange. The CO<sub>2</sub>-charged waters are usually more enriched in oxygen-18 due to more extensive water-rock reaction. Carbon-13 in the CO<sub>2</sub>-charged thermal waters is more depleted (-10 to -12 permil) than in the cold CO<sub>2</sub>-charged soda springs (-2 to -8 permil) which are also scattered throughout the Cascades. The hot and cold CO<sub>2</sub>-charged waters are supersaturated with respect to CaCO<sub>3</sub>, but only the hot springs are actively depositing CaCO<sub>3</sub>. Baker, Gamma, Sulphur, and Ohanapeosh seem to be associated with thermal aquifers of more than 100°C. (USGS)  
W83-00112

**WATER-QUALITY CHARACTERISTICS OF SIX SMALL, SEMIARID WATERSHEDS IN THE GREEN RIVER COAL REGION OF COLORADO,**  
Geological Survey, Lakewood, CO. Water Resources Div.  
For primary bibliographic entry see Field 5A.  
W83-00124

**A STUDY OF TRENDS IN TOTAL PHOSPHORUS MEASUREMENTS AT NASQAN STATIONS,**  
Geological Survey, Reston, VA. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W83-00126

**METHODS FOR COLLECTION AND ANALYSIS OF GEOPRESURED GEOTHERMAL AND OIL FIELD WATERS,**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
M. S. Lico, Y. K. Kharaka, W. W. Carothers, and V. A. Wright.  
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, \$3.50. Water-Supply Paper 2194, 1982, 21 p, 2 Fig, 22 Ref.

Descriptors: \*Geothermal studies, \*Thermal water, \*Oil fields, \*Chemical analysis, Geochemistry, Oil wells, Water sampling, Water analysis, Connate water, Brines, Geopressed.

Present methods are described for the collection, preservation, and chemical analysis of waters pro-

duced from geopressed geothermal and petroleum wells. Detailed procedures for collection include precautions and equipment necessary to insure that the sample is representative of the water produced. Procedures for sample preservation include filtration, acidification, dilution for silica, methyl isobutyl ketone (MIBK) extraction of aluminum, addition of potassium permanganate to preserve mercury, and precipitation of carbonate species as strontium carbonate for stable carbon isotopes and total dissolved carbonate analysis. Chemical parameters determined at the well site are sulfide, alkalinity, pH, ammonia, and conductivity. Laboratory procedures are given for the analysis of lithium, sodium, potassium, rubidium, cesium, magnesium, calcium, strontium, barium, iron, manganese, zinc, lead, aluminum, and mercury by atomic absorption and flame emission spectroscopy. Chloride is determined by silver nitrate titration and fluoride by ion-specific electrode. Bromide and iodide concentrations are determined by the hypochlorite oxidation method. Sulfate is analyzed by titration using barium chloride with thorin indicator after pretreatment with alumina. Boron and silica are determined colorimetrically by the carmine and molybdate-blue methods, respectively. Aliphatic acid anions (acetic through valeric) are determined by gas chromatography after separation and concentration in a chloroform-butanol mixture. (USGS)  
W83-00127

**THE CHEMISTRY AND PHYTOPLANKTON OF THE ORINOCO AND CARONI RIVERS, VENEZUELA,**  
Colorado Univ., Boulder. Dept. of Environmental, Population and Organismic.  
For primary bibliographic entry see Field 5B.  
W83-00187

**THE CHEMICAL COMPOSITION OF WATER AND THE ANALYTICAL CHEMIST: A CHALLENGE,**  
Hydrological Research Inst., Pretoria (South Africa).

For primary bibliographic entry see Field 5A.

W83-00290

**SEASONAL MASS BALANCE OF MAJOR IONS IN THREE SMALL WATERSHEDS IN A MARITIME ENVIRONMENT,**  
Dalhousie Univ., Halifax. Dept. of Biology.

J. G. Ogdene, III.

Water, Air, and Soil Pollution, Vol 17, No 2, p 119-130, 1982. 3 Fig, 5 Tab, 7 Ref.

Descriptors: \*Chemistry of precipitation, \*Ions, Watersheds, Marine climates, Seasonal variation, Small watersheds, Sodium, Potassium, Calcium, Magnesium, Chlorides, Sulfates, Conductivity, Alkalinity, Hydrogen ion concentration, \*Nova Scotia.

Precipitation and outlet stream water samples from three small watersheds in central Nova Scotia, Canada, were monitored at approximately monthly intervals from May 1977 to November 1978 for major ion chemistry. The watersheds, which ranged from 16.4 to 544 hectares in area, were located at distances of 0.5, 20, and 40 kilometers from the Atlantic coast. A total of 180 precipitation and 55 outlet stream flow samples were analyzed for sodium, potassium, calcium, magnesium, chloride, sulfate, phosphate, nitrate, bicarbonate alkalinity, pH, and conductivity. The results were compared to similar studies at Hubbard Brook, New Hampshire, and at Kejimkujik National Park, Nova Scotia. The proximity to Atlantic Ocean and Bay of Fundy coastal sources of marine aerosols was reflected in the major ion chemistry. The bulk of the deposition of marine ions occurred within 20 kilometers of the coast, although the most inland of the Nova Scotia stations (Kejimkujik and Kerr Lake) showed between 4 and 7 times the concentrations of marine ions as Hubbard Brook. Seasonal mass balances showed that more than 50% of the hydrogen ions in precipitation are retained in the watersheds (except for the Fink Cove ecosystem, which is ombrotrophic), principally at the expense of basic cations being leached

from the watersheds. Decreases in the output of both hydrogen ions and sulfate during the summer months appear to be the result of biological reduction to hydrogen sulfide (H<sub>2</sub>S). Deposition of excess sulfate in Nova Scotia through precipitation is primarily as sulfuric acid, rather than as the ammonium sulfate characteristic of continental precipitation. (Carroll-FRC)  
W83-00323

**STRATIGRAPHIC DIATOM AND CHEMICAL EVIDENCE FOR ACID STRIP-MINE LAKE RECOVERY,**  
Kent State Univ., OH. Dept. of Biological Sciences.

For primary bibliographic entry see Field 2H.  
W83-00329

#### 2L. Estuaries

**SEASONAL VARIATION OF ZOOPLANKTON OF THE VELI LAKE, SOUTH-WEST COAST OF INDIA,**  
Kerala Univ., Trivandrum (India). Dept. of Aquatic Biology and Fisheries.

For primary bibliographic entry see Field 2H.  
W83-00027

**SOME NOTES ON THE ECOLOGY OF AQUATIC OLIGOCHAETES IN THE DELTA REGION OF THE NETHERLANDS,**  
Provincial Water Authority, Zwolle (Netherlands). Dept. of Watershed Management.  
P. F. M. Verdonchot.  
Archiv für Hydrobiologie, Vol 92, No 1, p 53-70, August, 1981. 6 Fig, 1 Tab, 34 Ref.

Descriptors: \*Oligochaetes, \*Ecological effects, \*Sediments, Worms, Species distribution, Invertebrates, \*The Netherlands, Haringvliet-Hollands Diep, Aquatic habitats, Organic matter, Salinity, Benthic fauna, Tubifex, Peloscolex, Limnodrilus, Deltas, Shallow water, Water resources development.

Examination of aquatic oligochaetes collected during 1959-70 in the tidal channel sediments of the Delta area of the Netherlands revealed 2 distinct groups, mesohaline-marine and euryhaline-limnetic. Peloscolex benedeni was the most abundant species in the mesohaline-marine group. Chlorinity tolerances for each species were listed. Substrate affected distribution of some oligochaetes, P. benedeni thriving in anoxic sediments; Limnodrilus hoffmeisteri in well sorted muddy sand; Limnodrilus udekemianus in well sorted clay. Several species including Tubifex showed no preference for a particular substrate. Distribution with respect to organic content of the sediment was not clearly demonstrated. Distribution according to depth was seen only in Tubifex costatus, which was limited to shallow regions. When structures separated the Haringvliet-Hollands Diep from the North Sea in 1970, Tubifex development increased for 2 years due to the high organic content of the sediments. Chironomids and the oligochaete predator, Procladius spp, also increased. During 1971-77 species composition of the oligochaete fauna changed little, and several tubificid species shared the same habitat. The coexistence was possible because different species selectively removed various components (specific groups of bacteria or diatoms) from the organic sediments. (Cassar-FRC)  
W83-00035

**HEAVY METALS IN OYSTERS AND CLAMS OF ST. LOUIS BAY, MISSISSIPPI,**  
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.

For primary bibliographic entry see Field 5C.  
W83-00159

**ANOXIC NUTRIENT REGENERATION AND THE EUTROPHICATION OF ESTUARINE WATERS,**  
Rhode Island Univ., Kingston. School of Oceanography.

## Field 2—WATER CYCLE

### Group 2L—Estuaries

For primary bibliographic entry see Field 5C.  
W83-00263

## 3. WATER SUPPLY AUGMENTATION AND CONSERVATION

### 3A. Saline Water Conversion

#### DEVELOPMENT OF NEW CHEMICAL ADDITIVES AND TREATMENTS FOR SCALE CONTROL IN SALINE WATER EVAPORATORS, Battelle Columbus Lab., OH.

J. F. Miller, J. L. Means, A. E. Austin, and J. A. Eibling.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108308, Price codes: A05 in paper copy, A01 in microfiche. Final Report, January, 1982, 68 p., 18 Fig., 16 Tab., 8 Ref., 1 Append. OWRT C-00160-S (0460)(1).

Descriptors: \*Scaling, \*Saline water, \*Additives, \*Evaporators, \*Inhibitors, \*Desalination, Chemical properties, Chemical reactions, Corrosion, Fouling, Saline water systems, Salinity, Chemical treatment, Seawater, Evaluation, Design criteria, Retardants, Distillation, Distilled water.

Using laboratory procedures which simulated distillation conditions (including the presence of a heat-exchange surface), it was demonstrated that aminophosphonic acid additives in equivalent concentrations of 2-4.5 ppm in input sea water inhibited both alkaline and calcium sulfate scale deposition for extended periods. These periods were believed to be in excess of mean residence times for the brine in distillation systems operated in either once-through or recirculation modes. These periods were in excess of 200 hours and 70 hours at 125 and 142 degrees, respectively, at a concentration factor of 2.25 simulated sea water; and 16-17 hours at a concentration factor of one at 163 degrees on heat-transfer surfaces 13 to 16-plus degrees above this base temperature. Inhibitor costs were estimated at 1-3 cents/1000 gallons of input sea water to inhibit scale formation indefinitely under currently-used conditions, as indicated by the test results. Such use of the inhibitors will make operation under more efficient conditions possible, and would eliminate acid treatment and accompanying corrosion. Pilot-scale testing with the use of these inhibitors is recommended, based upon the success in the simulated study conducted. The inhibitors were hexamethylene-diaminetetra(methyleneephosphonic acid) and aminomethylphosphonic acid. (Zielinski-MAXIMA)

W83-00222

#### HYDRODYNAMICS AND FOULING OF PRESSURE DRIVEN MEMBRANE DESALINATION AND WATER TREATMENT SYSTEMS, Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

R. F. Probstein.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108480, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March, 1982, 36 p., 15 Fig., 2 Tab., 5 Ref. OWRT C-80301-S(8836)(1), 14-34-001-8536.

Descriptors: \*Model studies, \*Membrane processes, \*Reverse osmosis, \*Fouling, \*Desalination, Kinetics, Ultrafiltration, Membranes, Membrane filters, Scaling, Corrosion, Permeation, Fluctuations, Hydrodynamics, Fluid mechanics, Mathematical studies, Mathematical models.

A simple kinetic model is developed for rate of growth of a colloidal fouling film in steady unobstructed laminar and turbulent reverse osmosis systems. Experimental results are provided concerning the fouling of cellulose acetate membranes by a colloidal iron hydroxide suspension in saline solution. Data on foulant film thickness and deposition rate were found to be in good agreement with the model, and demonstrated that the characteristic build-up time of the foulant is controlled by foulant

and membrane properties. In a second phase of study, an optimization of flow conditions was developed for ultrafiltration (UT) in laminar channel flow systems that minimizes permeate product cost. Permeate flux-applied pressure data were obtained for bovine serum albumin (BSA) solutions with/without detached strip-type promoters, and optimum interpromoter spacing and flow condition values were determined. Further, the limiting flux in unpromoted UT systems was derived for laminar/turbulent flows using a thin-film model which afforded a method for determining gel diffusivity/concentration from solvent limiting flux data. BSA gelation properties were derived from laminar/turbulent channel flow experiments. The low polarization of laminar UT systems was also analyzed, and an integral method solution developed for flux as a function of flow conditions and solvent/solute properties affording good agreement between prediction and UT BSA flux-pressure data. (Zielinski-MAXIMA)

W83-00244

#### DEVELOPMENT OF CHLORINE RESISTANT MEMBRANES, POLYIMIDE MEMBRANES AND POROUS SUBSTRATES, Membrane Systems, Inc., San Diego, CA.

M. D. Heisler, M. E. McKee, J. E. Tomaschke, R. L. Fox, and J. D. Opydke.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108506, Price codes: A14 in paper copy, A01 in microfiche. Completion Report, December, 1981, 298 p., 92 Fig., 91 Tab., 9 Ref. OWRT C-00051-0(0502)(1), 14-34-0001-0502.

Descriptors: \*Membranes, \*Reverse osmosis, \*Membrane processes, \*Chlorination, \*Thin films, Desalination, Wastewater treatment, Water treatment, Polymers, Porous media, Synthesis, Engineering, Fabrication, Design criteria.

Concurrent studies were carried out for the development of chlorine-resistant composite membranes, polyimide (PI) membranes, and porous substrates for composite membranes. A synthesized tertiary polyamide (based on poly (oxetane) secondary diamine) was used to develop composite membranes which were evaluated for reverse osmosis (RO) performance on chlorinated feeds. A novel tertiary polyurethane (reaction of piperazine and ethylene bischloroformate) was also synthesized, and tested in composite membrane application using thin film deposition. Further, continuous machine fabrication technology was examined for asymmetric polyimide membranes having competitive RO performance, and PI thin film deposition was studied to form composite membranes. New porous supports were also developed, characterized, and successfully used in continuous thin film composite membrane formation. Refinements in formulation and fabrication conditions for PI membranes resulting in continuous machine casting in a 1-foot width to give membranes with exceptional transport properties. Control of key variables gave 50-foot long runs of continuous PI membrane with 14-17 GFD flux and 97.98% salt rejection. The results clearly demonstrate the ability to fabricate asymmetric (continuous sheet) PI membrane from commercial polymer and to incorporate this into a standard spiral element configuration. (Zielinski-MAXIMA)

#### DEVELOPMENT AND DEMONSTRATION OF A REVERSE-OSMOSIS ENERGY-RECOVERY DEVICE, SRI International, Menlo Park, CA.

G. B. Andeen, and J. C. Eid.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108605, Price codes: A03 in paper copy, A01 in microfiche. Final Report, June, 1982, 37 p., 16 Fig., 2 Tab., 4 Ref., 1 Append. OWRT C-00146-D(1403)(1), 14-34-0001-1403.

Descriptors: \*Reverse osmosis, \*Desalination, \*Desalination apparatus, \*Energy recovery, \*Mechanical equipment, Seawater, Desalination plants, Demineralization, Membranes, Membrane processes, Energy, Mechanical engineering, Pumps, Pressure head, Industrial plants.

An energy-recovery device for a seawater reverse-osmosis (RO) system was designed, fabricated, and tested. The device, comprised of a valving system, uses waste streams from an RO system to drive a pump which, in turn, sends additional feed flows to the RO elements. Test data demonstrated that efficiencies exceeding 95% can be expected, and, hence, energy consumption in a seawater RO desalination system can be decreased by 50%. Further, conversion may be decreased from 30% in order that membrane life is extended, and the size of the main pump and prime mover can be reduced by 50%. The device was subjected to almost 1000 hours (175,000 cycles) of testing, simulating its operation in a 4800 gallon/day seawater system, producing an outlet pressure of over 850 lbs/sq.in. for an inlet pressure of 750 lbs/sq.in. The device demonstrated an ability to self-start and to be controlled. An analysis of value and costs suggested that the device would be available to systems as small as 10,000 gallons/day. The results of this work confirm that significant improvements in the energy and economic performance of seawater desalination systems can be achieved. (Zielinski-MAXIMA)

W83-00256

#### DEVELOPMENT OF NOVEL POROUS SUBSTRATES FOR ULTRAFILTRATION, DESALINATION AND WATER RECLAMATION—PART III, Gulf South Research Inst., New Orleans, LA.

I. Cabasso, T. C. Shen, B. L. Zimny, and R. J. LeBoeuf.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108639, Price codes: A06 in paper copy, A01 in microfiche. Final Report, May, 1982, 113 p., 74 Fig., 11 Tab., 9 Ref. OWRT C-00151-D(0523)(1), 14-34-0001-0523.

Descriptors: \*Porous media, \*Ultrafiltration, \*Desalination, \*Reclaimed water, \*Synthesis, Porosity, Polymers, Electron microscopy, Water treatment, Water quality, Water quality control, Membrane processes, Composite membranes, Water reuse.

The objective of this overall project was to develop novel porous supports which can be used to fabricate composite membranes for desalination and water reclamation by reverse osmosis. Two commercially-available polymers were integrated: poly (phenylene oxide) and ethyl cellulose. The former (PPO), chemically-modified to the desired porous support via common water coagulating techniques, was described previously. The development of the ethyl cellulose (ET) support is currently reported. Several attempts to prepare the asymmetric (salt-rejecting) membrane from ET had limited success, and was discontinued due to inferior performance and particulate contamination in the commercial grade ET polymer. The attractiveness of ET over cellulose acetate resides in its pendent ester linkages (stable over a wide pH range), much lower surface energy and hydrophilicity, and, hence, the fine porous matrix prepared from ET via phase inversion by water coagulation does not collapse on drying. A variety of porous substrates were developed and studied. Further, hollow fibers and composite desalination membranes were prepared, the latter providing information for the preparation of conventional composite membranes using the ET substrate. Membranes developed from commercial ET were macrovoid-free, having a morphology corresponding to the ultimate structure needed from such porous supports. Membrane morphologies were studied using scanning electron microscopy. (Zielinski-MAXIMA)

W83-00259

#### A STUDY OF GLOW DISCHARGE POLYMERIZATION AS A MEANS OF PREPARING COMPOSITE REVERSE OSMOSIS MEMBRANES WITH ULTRATHIN SKIN, Missouri Univ.-Rolla. Dept. of Chemical Engineering.

H. Yasuda.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-107995, Price codes: A05 in paper copy, A01 in microfiche. Final Report, January, 1982, 80 p., 32 Fig., 7 Tab.

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Water Yield Improvement—Group 3B

15 Ref, 3 Append. OWRT C-80131-S(8525)(1), 14-34-0001-8525.

**Descriptors:** \*Reverse osmosis, \*Membranes, \*Synthesis, \*Membrane processes, \*Thin films, Polymers, Design criteria, Desalination, Water treatment, Porous media, Engineering, Fabrication, Process control.

Polymer thin film formation by glow discharge in organic vapors (glow discharge polymerization, or plasma polymerization (PP) from a monomer (3, g. styrene) produces polymers which are considerably different from those formed from the same monomer by conventional polymerization. Such plasma polymers form highly branched and cross-linked networks, excellent adhesion of a thin deposit to the substrate in glow discharge from low pressure plasma, are completely amorphous, and without macroscopic pinholes. Hence, an ideal composite reverse osmosis (RO) membrane can be prepared by PP using the proper porous substrate and PP conditions. Reproducibility and continuous operation feasibility, semi-continuous PP using hollow fibers was examined using a special constructed tandem reactor. Factors influencing continuous PP and variation of resultant RO membrane characteristics as a function of reaction time were investigated. While further improvement in the maximum salt rejection (90%) should be possible, the obtained water flux was exceptionally good. Allylamine plasma polymers produced had high chemical stability under extreme conditions of pH and in free chlorine oxidizing environments, superior to commercial RO membranes. Grafting acrylic acid onto the membrane surface improved its desalination characteristics. Further, PP can be used in continuous operation with very good reproducibility. (Zielinski-MAXIMA)  
W83-00260

#### PREPARATION OF THIN-ION-EXCHANGE MEMBRANES WITH EXCEPTIONALLY LOW RESISTANCES AND HIGH SELECTIVITIES.

Southern Research Inst., Birmingham, AL.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108001, Price codes: A03 in paper copy, A01 in microfiche. Final Report, February, 1982. 37 p, 10 Fig, 7 Tab, 6 Ref, 1 Append. OWRT C-00107-5(0442)(1), 14-34-0001-0442.

**Descriptors:** \*Ion exchange, \*Desalination, \*Membranes, \*Design criteria, \*Resins, Ion transport, Synthesis, Water treatment, Polymers, Thin films, Anion exchange, Cation exchange, Seawater, Saline water, Brackish water.

An investigation was carried out to develop improved ion-exchange membranes for desalting seawater or brackish waters with high salinities. Thin anion- and cation-exchange membranes were prepared that exhibit exceptionally low electrical resistances without sacrificing high current efficiencies (i.e., high selectivities) in solutions at seawater concentrations. The approach selected was based on filling (vacuum impregnation) the pores of thin microporous plastic (polypropylene) films with solutions of selected monomers. The monomers were subsequently polymerized and converted to anion- and cation-exchange resins. Laboratory reproducibility in the fabrication procedure for pinhole-free 6 in by 7 in membranes 1-2 mil thick was achieved. Anion-exchange membranes were fabricated with vinylbenzyl chloride 7.2% crosslinked by divinylbenzene (DVB) and post-quaternized with trimethylamine. Cation-exchange membranes were made with 2-acrylamido-2-methylpropanesulfonic acid 17% crosslinked by ethyleneglycol dimethacrylate, or from 5.5% styrene crosslinked by DVB and post-sulfonated with 2% of oleum. Dimensional and thermal stability are expected for these membranes since an appreciable volume of microporous film is not converted to an interpenetrating ion-exchange structure. Improved handling characteristics and lower replacement costs are anticipated. (Zielinski-MAXIMA)  
W83-00261

#### DEVELOPMENT OF COMPOSITE HOLLOW FIBERS - PHASE III,

Bend Research, Inc., OR.  
W. C. Babcock, R. W. Baker, R. P. Barss, B. A. Kruse-Smith, and H. K. Lonsdale.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108068, Price codes: A03 in paper copy, A01 in microfiche. Final Report, April, 1982. 35 p, 13 Fig, 7 Tab, 8 Ref. OWRT C-00154-D(5058)(1), 14-34-0001-0508.

**Descriptors:** \*Reverse osmosis, \*Membrane processes, \*Hollow fibers, \*Salt rejection, \*Feasibility studies, \*Desalination, \*Desalination apparatus, Desalination plants, Membranes, Demineralization, Design criteria, Saline water, Brackish water, Fouling, Hydraulic engineering, Industrial wastes, Wastewater treatment.

Precious work under this program to develop brackish water reverse osmosis (RO) modules that employ inside-skinned composite hollow fibers, led to the development of polysulfone hollow fiber support membranes having a high burst pressure and suitable water permeability and to the demonstration of brackish water desalting capability for polyamide-coated fibers. Further research was directed towards developing and testing modules containing 10 sq ft of membrane area. A number of such modules were prepared that rejected over 95% salt and had fluxes of about 10 gallons/sq ft at 400 pounds/sq in and 0.5 weight-% NaCl. The fouling resistance of these modules was demonstrated in field tests on pond water that contained about 1000 parts-per-million of suspended solids. In one test, a module was used for 40 days with only coarse filtration (100-micron filter) as pretreatment, during which, no significant module fouling occurred. These modules were also used in a plating shop for renovation of nickel-plating rinse waters. For this latter study, using only coarse filtration for pretreatment, no irreversible fouling occurred over 70 days of operation. Use of these modules can reduce RO desalting costs up to half. (Zielinski-MAXIMA)  
W83-00267

#### DIATOMITE PRECOAT FILTRATION FOR PRETREATMENT OF SEAWATER PRIOR TO REVERSE OSMOSIS.

Manville Service Corp., Denver, CO.  
G. R. Bell, and R. C. Himes.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108092, Price codes: A12 in paper copy, A01 in microfiche. Final Report, July, 1982. 253 p, 38 Fig, 24 Tab, 8 Ref, 3 Append. OWRT C-90272-D (9520)(1), 14-34-0001-9520.

**Descriptors:** \*Filtration, \*Seawater, \*Reverse osmosis, \*Diatomaceous earth, \*Financial feasibility, \*Desalination, Water treatment, Saline water, Cost-benefit analysis, Design criteria, Water quality, Water quality control, Testing procedures, Feasibility studies, Process control.

Investigation established that diatomaceous earth (DE) filtration could more consistently produce acceptable reverse osmosis feed water (based on 15-minute plugging index (PI-15) test data) than an existing central pretreatment (CPT) system over a substantial assessment period. The DE product was at or below 45 or 85% of all cycles. The CPT system was at or below 45 for only 42% of the same test days. Further, the DE product met its target PI-15 value of 40 or less, 53% of the time. Using DE to filter CPT system product gave PI values at/below 40 for 90% of 73 readings made, despite some substantial CPT system operating problems. Installed DE capital costs would be only about 40% of that for current CPT replication. Estimated operating and maintenance costs slightly favor DE over the CPT system by 14.4 to 16.3 cents/1000 gallons, respectively; addition of amortization decreases the total DE cost to only 58% that of the CPT system product. Of the DE processes evaluated, two have the capability of producing low PI-15 water. One process uses aluminum-hydrate coated DE; the other uses a separate feed of a cationic polymer, followed by DE body feed. While these products have similar PI-15 values, their other characteristics have notable differences requiring testing. (Zielinski-MAXIMA)  
W83-00270

### 3B. Water Yield Improvement

USE OF FRACTURE TRACES IN WATER WELL LOCATION: A HANDBOOK.  
For primary bibliographic entry see Field 4B.  
W83-00217

ANGORA GOATS FOR CONVERSION OF ARIZONA CHAPARRAL: EARLY RESULTS, Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.  
O. D. Knipe.

In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 264-269, 1 Fig, 3 Tab, 15 Ref.

**Descriptors:** \*Water yield improvement, \*Chaparral, \*Brush control, \*Goats, \*Arizona, Grazing, Shrubs, Grasses, Vegetation, Fires.

Conversion of Arizona chaparral to grass significantly increases water and forage yields, reduces fire hazard, and may increase wildlife values. Use of goats to convert chaparral to grass may be an alternative to chemical and mechanical means of brush control. Following prescribed burning and seeding with weeping lovegrass in the fall, 242 angora wethers were introduced into a 210-acre enclosure in June. Results indicate that the trampling of grass seed by goats in burned-over chaparral promotes germination and establishment. Since the goats relish young grasses, areas must be protected during grass establishment. Prescribed burning and goat browsing resulted in decreased shrub cover, increased herbaceous cover, and an apparent reduction in fire hazard and improvement in water yield. Goats utilized a far wider range of vegetation in the Arizona chaparral than other domestic livestock and resident big game, but chaparral species most preferred by goats are comparable to those of other domestic livestock and game. (Moore-SRC)  
W83-00299

STREAM WATER NUTRIENT CHANGES ASSOCIATED WITH THE CONVERSION OF ARIZONA CHAPARRAL, Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.  
For primary bibliographic entry see Field 5B.  
W83-00300

WATER YIELD CHANGES RESULTING FROM TREATMENT OF ARIZONA CHAPARRAL, Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.  
A. R. Hibbert, E. A. Davis, and O. D. Knipe.

In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 382-389, 5 Fig, 2 Tab, 10 Ref.

**Descriptors:** \*Chaparral, \*Water yield improvement, \*Watershed management, \*Streamflow, \*Brush control, Herbicides, Shrubs, Fires, Grasses, \*Transpiration, Perennial streams, Precipitation, \*Arizona.

Chaparral shrubs transpire large amounts of water, leaving an average of only about 30 mm (1.2 inches) or 5% for streamflow. Transpiration can be reduced and streamflow increased by removing part or all of the shrubs and replacing them with shallow-rooted grasses and forbs. Annual streamflow from small chaparral watersheds, in a 600-750 mm rainfall zone, was increased 75-150 mm and changed from intermittent to perennial flow by converting brush to grass with herbicides. Increases lasted up to 18 years with maintenance. At drier sites (450 mm rainfall) increases averaged less than 15 mm. Burning increased streamflow for 3-4 years while brush regrew. About 85% of the increase occurs in 6 fall-winter months which get 60% of

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3B—Water Yield Improvement

the precipitation. Yearly increases tend to be exponentially related to precipitation. (Moore-SRC) W83-00303

### 3C. Use Of Water Of Impaired Quality

**WATER RECLAMATION AND REUSE,**  
Alberta Univ., Edmonton. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5D. W83-00163

**ADJUSTMENT OF SOIL LIMITATIONS,**  
Stellenbosch Univ. (South Africa).  
For primary bibliographic entry see Field 2G. W83-00286

### 3D. Conservation In Domestic and Municipal Use

**ESTIMATING RUNOFF VOLUMES FROM URBAN AREAS,**  
Chalmers Univ. of Technology, Goteborg (Sweden). Institutionen foer Vattenbyggnad.  
For primary bibliographic entry see Field 4A. W83-00007

**SOCIAL AND POLITICAL ASPECTS OF DROUGHT,**  
Kraeger Associates, Ltd., Aptos, CA.  
For primary bibliographic entry see Field 6B. W83-00186

**WATER RESOURCE SYSTEM RELIABILITY UNDER DROUGHT CONDITIONS: THE SEATTLE WATER SUPPLY SYSTEM AS A CASE STUDY,**  
Washington Univ., Seattle. Dept. of Civil Engineering.  
S. H. Draper, R. N. Palmer, D. P. Lettenmaier, and S. J. Burgess.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108357, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 72, September 1981. 89 p, 21 Fig, 12 Tab, 28 Ref, 2 Append. OWRT B-080-WASH(1), 14-34-0001-9102.

Descriptors: \*Drought, \*Water supply systems, \*Water supply development, \*Model studies, \*Urban planning, Available water, Water repairs, Water management, Water supply, Mathematical studies, Water shortage, Water deficit, Drought resistance, Forecasting, Hydrologic aspects, Prediction, Projections, Weather Forecasting.

Several potential ways of increasing the resistance of water supply systems drought conditions through improved management/planning were examined, using the Cedar and Tolt River systems of western Washington. The use of drought indices to define/forecast hydrologic drought was assessed, particularly for the widely-used Palmer Drought Index; this index generally provided less accurate forecasts of future runoff deficiencies than hydrologic forecasting methods in current use. Simulation modeling appeared to be a more useful drought management tool. A detailed simulation model of the Cedar/Tolt system was developed that incorporates a method for characterizing system reliability in terms of supply deficits. The model study found that the proposed Seattle Water Department system expansion is needed if the system is to supply projected demands reliability by the year 2000; system reliability would be markedly improved by implementation of the city plan to increase the volume of active storage in the Cedar River reservoir. Further, the model study indicated that a Cedar reservoir seepage loss reduction may significantly improve system reliability, contrary to earlier analysis findings. The effects of alternate operating policies on system reliability and the role of instream flow needs and Lake Washington management are also assessed.

The model study illustrates the advantages of a demand-deficit approach over conventional safe yield analysis. (Zielinski-MAXIMA) W83-00229

**CASE STUDY ANALYSES OF 208 PROGRAM EFFECTIVENESS IN IMPROVING REGIONAL WATER RESOURCES MANAGEMENT,**  
Brown and Caldwell, Pasadena, CA.  
For primary bibliographic entry see Field 6B. W83-00240

### 3E. Conservation In Industry

**WATER AND WASTE MANAGEMENT IN THE CANADIAN MEAT AND POULTRY PROCESSING INDUSTRY,**

Stanley Associates Engineering Ltd., Edmo Edmonton (Alberta); and Dearborn Environmental Consulting Services, Mississauga (Ontario). Report No. EPS 3-WP-81-3, June, 1981. 207 p, 44 Fig, 58 Tab, 158 Ref, 4 Append.

Descriptors: \*Water management, \*Waste management, \*Canada, \*Meat processing industry, \*Poultry, Food processing industry, Water conservation, Industrial water, Water use, Water use efficiency, Water users, Waste disposal, Solid wastes, Liquid wastes, Waste recovery.

Following visits to Canadian and American meat/poultry processing plants to assess water and waste management practices, demonstration studies were conducted at two Canadian red meat and two Canadian poultry processing facilities to document the feasibility for in-plant control of water use and process effluent waste loadings. These studies confirmed that water use and waste load reductions could be accomplished at minimal cost. The major areas of water use reduction in the red meat processing plants involved shroud washing processes, employee handwashers, carcass washers, and viscera table washing systems; for poultry processing plants, this involved coop washing, feather transport, gooseneck handwashers, and rotary screen backwashing. Considerable process effluent waste load reductions at both red meat plants were attained, mostly by improving the blood recovery systems (in which process effluent BOD-5 was reduced from 48-56%). No significant decrease in waste loads was attained at either of the poultry processing plants. The maximum cost of any single modification installed was \$7700 (blood recovery system); the average cost of all other modifications was about \$500. At all four plants, modification costs could be recovered in less than one year. Reuse/recycle schemes were also identified. (Zielinski-MAXIMA) W83-00082

**PULP AND PAPER EFFLUENT MANAGEMENT,**

Tufts Univ., Medford, MA.; and National Council for Air and Stream Improvement, Inc., Medford, MA.

For primary bibliographic entry see Field 5D. W83-00164

**WATER MANAGEMENT IN THE OIL SHALE INDUSTRY,**  
CH2M/Hill, Bellevue, WA.

For primary bibliographic entry see Field 5D. W83-00185

### 3F. Conservation In Agriculture

**POLICY OBJECTIVES AND INFORMATION SYSTEM FOR IRRIGATION PROJECTS-INDIA,**

Center for Development Research, Hyderabad (India).

For primary bibliographic entry see Field 6A. W83-00011

**IRRIGATION PLANNING IN THE TANA BASIN OF KENYA,**

University Coll. of Swansea (Wales). Centre for Development Studies.  
For primary bibliographic entry see Field 6B. W83-00015

**THE PROBABILITY DISTRIBUTION OF WATER INPUTS AND THE ECONOMIC BENEFITS OF SUPPLEMENTARY IRRIGATION,**

International Inst. for Applied Systems Analysis, Laxenburg (Austria).  
For primary bibliographic entry see Field 6A. W83-00016

**CLIMATIC ASPECTS OF DROUGHTS,**  
Maryland Univ., College Park. Dept. of Meteorology.

H. E. Landsberg.  
Bulletin of the American Meteorological Society, Vol 63, No 6, p 593-596, June, 1982. 1 Tab, 34 Ref. Descriptors: \*Climatic data, \*Temporal distribution, \*Drought, \*Water management, \*Land management, Water deficit, Water shortage, Overdraft, Precipitation, Crop production, Semiarid lands, Runoff.

Due to the devastating effects of drought on crop production, much attention has been focused on understanding recurrence intervals of drought conditions. Analysis of long-time-series-of-occurrence data from many parts of the world suggests that drought incidence is usually characterized by the long wave pattern and by weakening of the intertropical convergence zone. Many indistinct regularities are common, but once a drought is established, its temporal persistence over several months is marked. Interannual persistence is infrequent. The prediction of drought is still in the experimental stages. In efforts to control the disastrous impact of drought conditions, major consideration must be given to land use. Mismanagement of land resources in semi-arid regions can lead to desert encroachment. Rehabilitation after desert sands have taken over, even when rains return, is a lengthy and costly struggle. In the meantime, greater water management skills will be needed to counteract the effects of drought on soil erosion, crop production, water supplies and hydroelectric power generation. (Geiger-FRC) W83-00188

**APPLICATION OF REMOTE SENSING IN EVALUATING FLOODWATER FARMING ON THE PAPAGO INDIAN RESERVATION,**  
Arizona Univ., Tucson. Office of Arid Lands Studies.

C. Hutchinson.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108365, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, March, 1982. 101 p, 10 Fig, 7 Tab, 49 Ref, 5 Append. OWRT C-90258-G (0515)(1).

Descriptors: \*Remote sensing, \*Floodwater, \*Wastewater farming, \*Crop production, \*Rainfall-runoff relationships, Farming, Water use, Available water, Surveys, Farms, Irrigation water, Catchments, Growth rates, Reservoir storage, Precipitation, \*Arizona, \*Papago Indian Reservation.

The geographic setting and ecological functions of the traditional farming system are described. A survey of the fields revealed that cultivated acreage decreased from 3068 in 1913 to 125 in 1981. Hydrologic computer modeling was performed for one of the surveyed fields by estimating bimonthly water yield of the water catchment during the July-October growing season, and compared to consumptive use requirements of the crops. Crop success appeared related to growing seasons having more evenly-distributed bimonthly water yields. However, total seasonal water yield may not reflect crop success when rains are concentrated in one or two bimonthly periods. Further, ephemeralized crops are deemed more successful than water use efficient crops with longer growing seasons. Crop success probability can be improved by farmers by managing floodwater delivery to fields

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Conservation in Agriculture—Group 3F

in two ways: storage of soil moisture in the soil of the cultivated fields; reservoir storage of floodwater for irrigation during critical dry periods. Current Papago water/crop management practices have been little-affected by modern technologies; they, rather, are local adaptations of native American/historic Hispanic methods refined over centuries. (Zielinski-MAXIMA)  
W83-00230

#### VARIABILITY IN CROP PHYSIOLOGICAL AND MORPHOLOGICAL CHARACTERISTICS CONTROLLING WATER USE EFFICIENCY AND GRAIN YIELD,

Nebraska Univ.-Lincoln, Inst. of Agriculture and Natural Resources.

J. D. Eastlin, C. Y. Sullivan, and C. A. Francis.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108407, Price codes: A0

Descriptors: \*Water efficiency, \*Irrigation practices, \*Crop yield, \*Plant physiology, \*Plant morphology, \*Grain crops, Crop production, Irrigation water, Irrigation efficiency, Plant growth, Agriculture, Farming, Soil water, Sorghum, Corn, Thermal stress, Temperature effects, Water use.

Water and temperature stress variables were imposed on sorghum, pearl millet, and corn in growth room and field tests to evaluate comparative performances. Seed number correlates positively with grain yield in most cereals; seed number per sq m was considerably more stable under stress in sorghum than in corn. Temperatures 5 degrees above ambient at night in sorghum field tests for weekly intervals during panicle development reduced yields the most (28%) during the week following appearance of pistil and stamen primordia. This reduction paralleled a 29% seed number reduction, primarily due to the lack of floret formation than floret abortion. Root production was rapid during panicle development prior to bloom, and may be a competing sink to the panicle. A stress-tolerant sorghum hybrid produced roots at half the oxygen consumption rate as a normal hybrid. Line source water-gradient comparisons between corn and sorghum in Kansas and Nebraska showed sorghum as more stable in grain yield and the seed number component of the yield. Water use efficiencies were higher for sorghum on dryland and low (at/below 4 inches) irrigation levels, while those for corn were higher at higher irrigation levels, mainly due to a 75% longer grain filling period. (Zielinski-MAXIMA)  
W83-00234

#### WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTH-WESTERN NEW MEXICO, PHASE I,

New Mexico State Univ., Las Cruces, Dept. of Agricultural Engineering.

C. E. Kallson, E. J. Gregory, and E. J. Sammis.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108415, New Mexico Water Resources Research Institute, Las Cruces, WRRI Report No 137, August, 1981. 94 p, 13 Fig, 30 Tab, 10 Ref, 3 Append. OWRT C-90229 (9444)(1).

Descriptors: \*Irrigation practices, \*New Mexico, \*Agronomic crops, \*Mathematical equations, \*Crop yield, Irrigation water, Water use, Water use efficiency, Fertilization, Crop production, Consumptive use, Nitrogen, Evapotranspiration, Hydroscopic coefficient, Mathematical studies, Mathematical models, Model studies, Water supply.

Effective irrigation practices require a knowledge of the consumptive use requirement of the given crop; consumptive water use as influenced by the level of nitrogen fertilization was investigated for spring barley, pinto beans, and field corn in northwestern New Mexico for the 1980 growing season. Potential evapotranspiration was calculated by several methods, and crop coefficients were developed. Crop yield was demonstrated to be significantly and highly correlated to seasonal evapotranspiration. Crop coefficients greater than unity were routinely achieved at the higher yield levels which

occurred during peak evapotranspiration. As the level of nitrogen fertility was increased (from 10 to 200 kg/hectare), the maturation period of the crop lengthened and its growth rate increased. The level of nitrogen fertility, however, did not appear to affect the water use efficiency of the developing crop. Both linear and curvilinear water production functions were produced, with the form of the function varying with the crop. Grain corn yield was accurately predicted using the seasonal consumptive use by a previously-developed water production function. Water production functions for all three crops are presented in respective equation. Further study will allow for a refining of the investigative technique used, as well as for a replication of the experimental methods between different seasons. (Zielinski-MAXIMA)  
W83-00235

#### RURAL WATER SUPPLY SYSTEMS: IMPROVED PLANNING STRATEGIES THROUGH SYSTEMS ANALYSIS,

Iowa State Univ., Ames, Dept. of Civil Engineering.

For primary bibliographic entry see Field 6A.  
W83-00241

#### EFFICIENT USE OF WATER FOR IRRIGATION IN THE UPPER MIDWEST,

Iowa State Water Resources Research Inst., Ames, T. A. Austin, C. E. Anderson, H. P. Johnson, R. H. Shaw, and J. Golchin.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108464, Price codes: A07 in paper copy, A01 in microfiche. Completion Report ISWRRI-117, June 1982. 145 p, 23 Fig, 29 Tab, 8 Ref, 1 Append. OWRT B-120-ILL(5).

Descriptors: \*Irrigation efficiency, \*Surface water availability, \*Hydrologic budget, \*Hydrologic models, \*Agricultural hydrology, \*Computer programs, Irrigation, Available water, \*Soil moisture deficiency, Irrigation operation, Irrigation practices, Irrigation requirements, Irrigation water, \*Midwest U.S., Water storage, Groundwater availability, Computer models, Hydrologic budget, Model studies, Corn, Crop yield.

Land used for irrigation in the upper Midwest U.S. region (including Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri) increased almost 3-fold from 1969-1979. Assessment was made of ground and surface water availability for further irrigation expansion. The most probable irrigation expansion areas appear to be lands near alluvial aquifers associated with major rivers, or in areas where bedrock aquifers are near the surface. Adequate surface water resources are available for further irrigation development, particularly in the southern half of the region. Carryover water storage will probably be needed, however, for protection during annual short-term variations in surface water resources and against long-term droughts. Direct diversions to assist irrigation water needs will only be possible from the major region rivers and their tributaries. A water balance computer model predicted the frequency of soil moisture for soils typical to the region. Soil moisture shortage occurs on days when soil moisture in the top 5 feet is less than 50% of the available soil moisture. A soil moisture/crop yield computer program was used to predict increases in corn yield due to irrigation. Prediction of yield increases were made for Lamberton, Minnesota and for Fayette County, Illinois. (Zielinski-MAXIMA)  
W83-00242

#### DENDROGRAPHY FOR OPTIMAL WATER AND ENERGY UTILIZATION IN PLANT GROWTH,

Iowa State Univ., Ames.

C. P. Burger, R. B. Hall, and L. C. Promnitz.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108043, Price codes: A06 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Report ISWRRI-101, Iowa State University, Ames, July, 1982. 105 p, 9 Fig, 18 Ref, 4 Append. OWRT B-062-IA(7), 14-34-0001-8086.

Descriptors: \*Water stress, \*Plant growth, \*Statistical analysis, \*Strain gages, Irrigation practices, Water requirements, Water use, \*Soybeans, \*Poplar Trees, Statistics, Electrical resistance, Electrical properties, Error analysis, Drought, Computer models, Temperature effects.

Study was made of water stress and growth in young poplar trees and soybeans using a new technique involving electrical resistance strain gages. The principal sources of error introduced by the gages and data acquisition equipment were evaluated and overcome. Errors caused by temperature fluctuations were found to be small, compared to the physiological responses of the plants to daytime temperature changes. Two large-scale statistical tests were completed: the first established the nature of individual and coupled effects of light and ambient temperature on evaporation, growth and stem changes of young trees; the second assessed the effect of small soil mineral differences on plant drought resistance. Phosphate deficiencies were found particularly harmful. Extensive soybean field tests confirmed the value of the new strain technique in short term evaluation of different planting patterns, and of irrigation procedures on water stress development in soybeans. Stem size change tests attributable to xylem/bark contractions showed that the xylem is not rigid (as often assumed in plant water stress models), and illustrated sap flow changes that occur when a plant is severely stressed and able to recover and when it is damaged and suffers physiological damage. (Zielinski-MAXIMA)  
W83-00265

#### INCENTIVES FOR IRRIGATION WATER CONSERVATION IN AGRICULTURE,

Texas Tech Univ., Lubbock, Dept. of Industrial Engineering.

B. K. Lambert, S. S. Panwalkar, and S. Kajila.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108159, Price codes: A05 in paper copy, A01 in microfiche. Completion Report May, 1982. 67 p, 2 Fig, 15 Tab, 29 Ref, 1 Append. OWRT B-251-TEX(1), 14-34-0001-1270.

Descriptors: \*Irrigation water, \*Water conservation, \*Irrigation practices, \*Cost analysis, \*Model studies, Irrigation, Irrigation districts, Texas. Irrigation efficiency, Irrigation operation, Irrigation requirements, Sprinkling, Sprinkler irrigation, Surface irrigation, Cost-benefit analysis, Tangible benefits, Cost sharing, Economic aspects, Financing.

Potential irrigation water conservation incentives for the Texas High Plains region were examined, and the opinion of area growers was assessed relative to the desirability/effectiveness of these potential incentives. Economic analysis of sprinkler/surface irrigation systems was conducted using the Life Cycle Costing (LCC) method to determine the impact of potential economic incentives on irrigation system selection. These incentives included: accelerated depreciation methods; low interest loans having different repayment schedules; and cost sharing. The ancillary impact of inflation and rising energy costs were included in incentives evaluation. Analyses indicated that low interest loans coupled with favorable depreciation methods may provide a feasible incentive for water-conserving equipment purchases (e.g., sprinkler systems). Current incentive programs are accepted by farmers and should continue, with further emphasis on the availability of technical help and demonstration projects, and an improved method for cost sharing or the development of low interest loans with a favorable repayment schedule. Discussions with area growers produced suggestions for improving existing incentive programs and for potential future irrigation water conservation incentives. (Zielinski-MAXIMA)  
W83-00278

#### WATER SAVING TECHNIQUES,

Texas Agricultural Experiment Station, Lubbock.

W. M. Lyle.

In: Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3F—Conservation In Agriculture

High Plains, April 1-2, 1982. WRRI Report No 145, May 1982, p 72-82, 4 Tab, 4 Ref, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.

Descriptors: \*Irrigation, \*Furrow irrigation, \*Sprinkler irrigation, \*Trickle irrigation, \*Irrigation efficiency, \*Application rates, Rainfall penetration, Water use efficiency, Soil moisture retention, Cost analysis, Optimal yield, Irrigation practices, Irrigation requirements, Water loss, Water potentials, \*New Mexico, Water conservation.

Eastern New Mexico's water resources include irrigation water and rainfall. For an effective irrigation-soil-crop system, maximum amounts of water must be stored in the soil root zone. Controlling the flow of water produces the highest efficiency. Conventional furrow and sprinkler systems have to many variables—soil intake rates, soil non-homogeneity, length of run, slope—to give precise control. A low energy-precision application (LEPA) system was designed which distributes water directly to the furrows at very low pressure through drop tubes and orifice controlled emitters and is used in conjunction with microbasin land preparation. Little water loss occurred during LEPA testing; the average application efficiency was over 98% when used with the furrow dikes which are necessary to the system. To obtain water use efficiency each irrigation treatment (LEPA, sprinkler, furrow) was applied to either basin or conventionally tilled land. The average yield from each treatment was divided by the gross water applied, and varied from 2.07 to 2.76 over the two year period. The LEPA system could decrease energy consumption by lowering net irrigation requirements through great rainfall retention in supplemental irrigated areas, by high application efficiency, by high distribution efficiency, and by lowering operating head requirements. A summary table shows net returns realized by each treatment over the irrigation energy expense, using an example of soybeans at \$8.00/bushel (1980) and \$5.00/bushel (1981) and a \$0.05/kw-hr energy cost. The best return was the basin tilled LEPA system at \$442.40; the worst was the conventional tilled sprinkler system at \$307.20. (Atkins-Omniplan) W83-00309

**IRRIGATION SCHEDULING,**  
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.

J. R. Gilley.

In: Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the High Plains, April 1-2, 1982. WRRI Report No 145, May 1982, p 83-92, 1 Fig, 3 Ref. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.

Descriptors: \*Irrigation scheduling, \*Irrigation efficiency, \*Irrigation practices, \*Soil moisture deficiency, \*Monitoring, Hydrologic budget, Optimal yield, Crop yield, Soil types, Hydrologic models, Evapotranspiration, Climatic data, Rainfall infiltration.

Irrigation water management is important for reasons that include water and energy conservation, reduced production costs, and yield improvements. Irrigation scheduling is a determination of when and how much to irrigate with an additional component of specific management objectives, such as maximum yield or economic benefit, minimum leaching, or maintaining the salt balance. The agricultural engineering department at the University of Nebraska has developed an irrigation scheduling model called IRRIGATE for the agricultural computer network (AGNET) system. The basic component of the model is the on-farm water balance, which is the disposition of water during and after an irrigation event. IRRIGATE can be used with a variety of irrigation systems, nine common crops, eight soil types, and a minimum of climatic data. Soil moisture depletions should not exceed a particular value (usually 50% of the soil's available water holding capacity) to prevent crop stress and yield decline. The model automatically builds and maintains a field file which stores rainfall, irrigation and soil moisture data. Irrigations are scheduled

based on the soil moisture depletions at the two extreme positions of a field, the normal start and stop positions of an irrigation cycle. Periodic soil moisture readings provide the necessary feedback to ensure that scheduling is based on the best estimate of soil moisture depletion. Depending on soil type, various types of soil monitors are used. The output of the program has three components: the update; forecast; and schedule. (Atkins-Omniplan) W83-00310

### CONSERVATION THROUGH CROPS RESEARCH,

New Mexico State Univ., Las Cruces. Dept. of Agronomy.

M. H. Niehaus.

In: Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the High Plains, April 1-2, 1982. WRRI Report No 145, May 1982, p 122-127, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.

Descriptors: \*Irrigation, \*Irrigation effects, \*Water conservation, \*Crop production, \*Research priorities, Crop yield, Water management, Water supply, Water shortage, Tolerance, Drought resistance, Alfalfa, Sorghum, Cotton, \*New Mexico.

Research is underway or being planned to identify crops that will conserve New Mexico's increasingly scarce and expensive irrigation water. This paper discusses research on conventional existing crops and research on new crops. In 1979, a hybrid cotton showed a 3 to 36% yield advantage over conventional cotton and produced more fiber per unit of water. Cotton can also be predisposed to require either more or less water by the amount and timing of irrigation during early growth. Alfalfa, which is drought tolerant, is New Mexico's most important cash crop. A current project has shown that there is greater variation in alfalfa for its ability to grow and produce when given limited water and that this characteristic can be passed on to the next generation. Research on sorghum, also a drought resistant crop, is aimed at higher yield of protein. Researchers have found that use of anti-transpirants can increase sorghum and other crop yields, particularly when water is limiting. Furrow diking and water harvesting have also resulted in yield increases. New areas of research center on introducing new crop species to the southwest from other parts of the world and on domesticating wild species. Crops currently being studied include: crambe, a seed high in oil, which has a short growing season and, therefore, uses less water than other crops; guar, which does well on poor soil and also uses little water; kochia, which researchers are trying to convert from a weed to a desirable forage crop; jojoba; and millet. Unfortunately, funding is limited, which hampers the much needed research to find and develop these and other species into crops adapted to the arid southwest. (Atkins-Omniplan) W83-00311

### 4. WATER QUANTITY MANAGEMENT AND CONTROL

#### 4A. Control Of Water On The Surface

##### ESTIMATING RUNOFF VOLUMES FROM URBAN AREAS,

Chalmers Univ. of Technology, Goeteborg (Sweden). Institutionen foer Vattenbygand.

V. Arnell.

Water Resources Bulletin, Vol 18, No 3, p 383-387, June, 1982, 4 Fig, 2 Tab, 12 Ref.

Descriptors: \*Runoff volume, \*Rainfall-runoff relationships, \*Urban drainage, \*Mathematical models, Mathematical studies, Mathematical equations, Urban areas, Regression analysis, Catchment areas, Model studies, Rainfall.

An equation for estimating runoff volumes from urban areas was formulated based on the part of a total area contributing to runoff, the rainfall amount for a single event, and the initial rainfall losses. For the evaluation of the part of a total area contributing to runoff and the initial rainfall losses, rainfall/runoff measurements were taken in five residential catchment areas ranging in size from 0.035 sq km to 1.450 sq km. Initial rainfall losses were found to vary from 0.38 mm to 0.70 mm for the different test sites according to linear regression analysis of rainfall volumes versus runoff volumes. The parts of the areas contributing to runoff were proportional to the impermeable parts of the areas. The present equation may be applied to the estimation of runoff volume in urban sections with well defined paved surfaces and roofs and with a negligible amount of runoff from permeable areas. (Geiger-FRC) W83-00007

### WATER RESOURCES DATA, LOUISIANA, WATER YEAR 1981—VOLUME 2, SOUTHERN LOUISIANA.

Geological Survey, Baton Rouge, LA. Water Resources Div.

For primary bibliographic entry see Field 7C.

W83-00057

### LOW-FLOW CHARACTERISTICS AND FLOW DURATION OF NEW JERSEY STREAMS,

Geological Survey, Trenton, NJ. Water Resources Div.

For primary bibliographic entry see Field 7C.

W83-00061

### REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS-OKLAHOMA, 1980 WATER YEAR,

Geological Survey, Little Rock, AR. Water Resources Div.

G. L. Ducret, Jr.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$3.50 in paper copy, \$3.50 in microfiche. Open-File Report 82-168, 1982, 25 p, 1 Fig, 3 Tab, 2 Ref.

Descriptors: \*Streamflow, \*Interstate compacts, \*Water yield, Reservoir storage, Hydrologic data, River basins, \*Arkansas, \*Oklahoma, \*Arkansas River basin.

The computed annual yield and deficiency of the subbasins as defined in the Arkansas River Compact, Arkansas-Okahoma, 1980, are presented. Actual runoff from the subbasins and depletion caused by major reservoirs in the compact area are also given. Monthly, maximum, minimum, and mean discharges are shown for the 14 streamflow stations used in computing annual yield. (USGS) W83-00063

### POTENTIAL FLOOD AND DEBRIS HAZARDS AT COTTONWOOD COVE, LAKE MEAD NATIONAL RECREATION AREA, CLARK COUNTY, NEVADA,

Geological Survey, Carson City, NV. Water Resources Div.

For primary bibliographic entry see Field 2E.

W83-00070

### ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1981,

Geological Survey, Helena, MT. Water Resources Div.

For primary bibliographic entry see Field 2E.

W83-00071

### WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN NEW MEXICO, FISCAL YEAR 1980.

Geological Survey, Albuquerque, NM. Water Resources Div.

For primary bibliographic entry see Field 7A.

W83-00073

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Control Of Water On The Surface—Group 4A

**SELECTED HYDROLOGIC AND CLIMATOLOGIC DATA FROM THE PRAIRIE DOG CREEK BASIN, SOUTHEASTERN MONTANA, WATER YEAR 1980,**  
Geological Survey, Helena, MT. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W83-00074

**ADAPTATION OF THE ILLUDAS MODEL TO A DESK-TOP COMPUTER,**  
Canada Centre for Inland Waters, Burlington (Ontario).  
For primary bibliographic entry see Field 7B.  
W83-00081

**HYDROLOGY AND WATER RESOURCES OF THE DRAKENSBERG,**  
Natal Univ., Durban (South Africa). Dept. of Agricultural Engineering.  
R. E. Schulze.  
Report No. 6 (Natal Town and Regional Planning Reports, Vol 42), 1979. 179 p, 70 Fig, 22 Tab, 112 Ref.  
W83-00122

Descriptors: \*Water supply, \*Statistical methods, \*Soil erosion, Hydrologic aspects, \*South Africa, Water resources development, Rainfall, Surveys, Decision making, Planning, Droughts, Nonlinear programming, Flow index, Model studies, Mathematical studies, Rainfall intensity, Rainfall impact, Regression analysis, Soil conservation, Drakensberg mountains, Umzimkulu river system.

The Drakensberg mountain range, together with its foothills and adjacent flatlands, is of particular significance area of the country's water supply. It affords large annual and seasonal water to augment deficits elsewhere. A survey of the hydrology and water resources of the Drakensberg was undertaken to assist decision makers and planning strategies. A number of findings were made. Agricultural droughts (below 25 mm rainfall in 21 days) averaged from 0.24 times (summer) to 1.32 times (winter). The mapping of patterns of rainfall amounts constituting upper rainfall limits for drought and severe drought years and wet seasons afforded a statistical method having planning implications for identifying drought areas. A nonlinear statistical relationship was derived linking streamflow and rainfall. One significant finding from a planning aspect (from analysis of monthly streamflow data) was the vast potential of the Umzimkulu river system, which displayed not only high flows but also low coefficients of variability of flow. Tests of soil loss elimination model for South Africa revealed that the model was particularly sensitive to inputs of rainfall energy and soil erodibility. The results of this survey should assist objective decisions by public/private authorities concerned with the Drakensberg hydrology and water resources. (Zielinski-MAXIMA)  
W83-00085

**THE ANALYSES OF AREAL RAINFALL USING MULTI-QUADRATIC SURFACES,**  
Department of Water Affairs, Pretoria (South Africa). Div. of Hydrology.  
For primary bibliographic entry see Field 2B.  
W83-00088

**STREAMFLOWS AND CHANNELS OF THE GREEN RIVER BASIN, WYOMING,**  
Geological Survey, Cheyenne, WY. Water Resources Div.  
H. W. Lowham.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-207416, Price codes: A05 in paper copy, A01 in microfiche. Water-Resources Investigations 81-71, May 1982. 73 p, 36 Fig, 4 Tab, 28 Ref.

Descriptors: \*Streamflow, \*Flow characteristics, \*Channel morphology, \*Dye releases, Tracers, Channel erosion, Stream banks, Gaging stations, Data collections, Discharge measurement, Regional analysis, Flood peak, Bankfull stage, Traveltime, \*Wyoming, Green River basin.

Width, depth, cross-sectional area, and velocity of streamflow were depicted for 51 gaged sites in or near the Green River basin of Wyoming by summarizing data obtained from current-meter discharge measurements. Using these at-a-station relations as base, regional relations were then developed that characterize hydraulic features of streams throughout the study area. Channel size is an indication of flow magnitude. High flows affect channel formation, and the annual peak-flow array is a representation of these flows. The geometric mean of this array is a viable statistical index of channel-forming flows because it represents the relative magnitude of high flows at a site. Bankfull discharge is a physical index of flows dominating channel formation. The magnitude of the geometric mean approximately equates to bankfull discharge, on the average. Relations depicting hydraulic characteristics of a discharge equal to the geometric mean of annual peak flows may, therefore, be considered to be generally representative of channel conditions existing during bankfull discharge. The relations have application for predicting channel response to developments that would alter streamflow. (USGS)  
W83-00122

**WATER-QUALITY ASSESSMENT OF STEINER BRANCH BASIN, LAFAYETTE COUNTY, WISCONSIN,**  
Geological Survey, Madison, WI. Water Resources Div.  
S. J. Field, and R. A. Lidwin.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-215757, Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 81-52, March 1982. 58 p, 17 Fig, 21 Tab, 27 Ref.

Descriptors: \*Water quality, \*Agricultural watersheds, \*Streamflow, \*Stream discharge, Erosion, Nonpoint pollution sources, Path of pollutants, Suspended sediments, Sediment yield, Water temperature, Dissolved solids, Data collections, Sampling, Water analysis, Nutrients, Nitrogen, Phosphorus, Storm runoff, \*Wisconsin, Lafayette County, Steiner Branch basin.

Steiner Branch basin in southwestern Wisconsin has rugged mature topography where few conservation practices are followed to reduce soil losses. This report assesses the magnitude and types of nonpoint discharges that affect the water quality of Steiner Branch. The 1978 water year discharge was about 90% of the average and the 1979 discharge was 120% of average. Streamflow during the 2-year study period ranged from 1.5 cubic feet per second, which is approximately the low flow that occurs on the average of once every 2 years, to 392 cubic feet per second, a discharge of about a 5-year flood-recurrence interval. Suspended-sediment yields were 369 tons per square mile in the 1978 water year and 84.6 tons per square mile in 1979. These yields were 1.66 times higher than those monitored in an adjoining basin where more typical conservation practices were employed. However, sediment discharge per unit of stream discharge was only 1.30 times higher in the Steiner Branch basin than in the adjoining basin. The estimated long-term annual suspended-sediment yield for the Steiner Branch basin is 444 tons per square mile. The majority of the nutrient load of the stream was transported during runoff events whereas transport of nitrite plus nitrate nitrogen and total nitrogen occurred primarily during baseflow conditions. (USGS)  
W83-00123

**INVESTIGATION OF TRENDS IN FLOODING IN THE TUG FORK BASIN OF KENTUCKY, VIRGINIA, AND WEST VIRGINIA,**  
Geological Survey, Reston, VA. Water Resources Div.

R. M. Hirsch, A. G. Scott, and T. Wyant.  
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, \$4.75. Water-Supply Paper 2203, 1982. 37 p, 24 Fig, 16 Tab, 38 Ref, 5 Append.

Descriptors: \*Floods, \*Statistical analysis, \*Small watersheds, \*Land use, Flood peak, Flood recur-

rence interval, Rainfall, Storm runoff, Flood plains, Sediments, Flow characteristics, Strip maps, Flood data, \*Tug Fork basin, Kentucky, Virginia, West Virginia.

Statistical analysis indicates that the average size of annual flood peaks of the Tug Fork (West Virginia and Kentucky) has been increasing. However, additional statistical analysis does not indicate that flood levels exceeded typically once or twice a year in the period 1947-1979 are any more likely to be exceeded now than in 1947. Possible trends in stream-channel size are also investigated at three locations. No discernible trends in channel size are noted. Further statistical analysis of the trend in the size of annual flood peaks shows that much of the annual variation is related to local rainfall and to the 'natural' hydrologic response in a relatively undisturbed subbasin. However, some statistical indication of trend persists after accounting for these natural factors, though it is of borderline statistical significance. This suggests the need for further study in the basin that may relate flood magnitudes to both rainfall and to land use. (USGS)  
W83-00128

**WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1981—VOLUME 3. WESTERN NEW YORK,**  
Geological Survey, Albany, NY. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W83-00131

**WATER RESOURCES DATA FOR NORTH CAROLINA, WATER YEAR 1981,**  
Geological Survey, Raleigh, NC. Water Resources Div.  
For primary bibliographic entry see Field 7C.  
W83-00132

**AQUATIC WEED CONTROL WITH ENDOTHALL IN A SALT RIVER PROJECT CANAL,**  
F. G. Corbus.  
Journal of Aquatic Plant Management, Vol 20, p 1-3, January, 1982. 1 Fig, 2 Tab, 2 Ref.

Descriptors: \*Herbicides, \*Aquatic weed control, \*Canals, Weed control, Aquatic weeds, Water supply, Municipal water, Algal control, Performance evaluation, Surface water, Arizona, Salt River Project, Tempe Canal.

Few methods of aquatic weed control are acceptable or practical where municipal and industrial quality water is required. The effectiveness of Hydrothol 191 in controlling aquatic weeds was investigated in the Salt River Project 10 mile Tempe Canal, located in south central Arizona. Hydrothol 191 is the mono (N,N-dimethylalkylamine) salt of 7-oxabicyclo(2.2.1)heptane-2,3-dicarboxylic acid. Seven applications of Hydrothol 191 at 0.2 parts per million (ppm) active ingredient were made at 2 week intervals in the Canal. The Tempe Canal empties into the Western Canal which, except for the first 0.5 mile, was treated with acrolein at the same 2 week intervals. Hydrothol 191 is currently in the advanced stage of Environmental Protection Agency (EPA) label consideration for a 3 ppm unrestricted use in municipal and industrial water sources and is available for municipal and industrial water use in Arizona for applications at 0.2 ppm. Hydrothol 191 was effective in controlling both sage pondweed (*Potamogeton pectinatus* L.) and filamentous algae, primarily *Cladophora* and *Spirogyra*, in the 10 miles of the Tempe Canal. Sago pondweed was eliminated in one stretch of the canal and nearly eliminated in another in response to the treatment. No synergism between Hydrothol 191 and acrolein was observed in the Western Canal. (Carroll-FRC)  
W83-00166

**AN ALTERNATIVE TO THE PERIPHERAL CANAL,**  
California Univ., Davis. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6G.  
W83-00193

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

**RESERVOIR MANAGEMENT IN POTOMAC RIVER BASIN,**  
Washington Univ., Seattle. Dept. of Civil Engineering.

For primary bibliographic entry see Field 6A.

W83-00203

**APPLICATION TO THE DES MOINES RIVER OF MULTIPLE RESERVOIR OPERATING STRATEGIES INCORPORATING SHORT-AND-LONG-TERM INFORMATION IN REAL TIME,** Iowa Univ., Iowa City. Inst. of Hydraulic Research.

P. K. Kitanidis.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108522, Price codes: A02 in paper copy, A01 in microfiche. IHR Limited Distribution Report No. 92, June 1982. 18 p, 5 Fig, 13 Ref. OWRT A-077-IA(1), 14-34-0001-1117.

Descriptors: \*Reservoir operation, \*Optimization, \*Linear programming, \*Stochastic hydrology, \*Reservoirs, Operating policies, Optimum development plans, \*Des Moines River, Systems analysis, Mathematical analysis, Statistical analysis, Stochastic process, Mathematical studies, Probabilistic process, Reservoir storage, Prediction, \*Iowa.

Optimal reservoir operation is a complex and important problem. The problem of optimizing the operation of two Des Moines River, Iowa reservoirs (Saylorville and Red Rock), was segregated into four sub-problems for reservoir operation: during normal flow period, during minor and major floods, and under drought conditions. Each sub-problem reflects a different reservoir operation mode based on the hydrologic situation. Two particular problems were solved. The first dealt with the means for determining the optimum operation of Saylorville Reservoir under drought conditions, and illustrates the use of stochastic dynamic programming. The second problem was that of conjunctive operation of both reservoirs during a period of minor floods, and illustrates the use of Linear Quadratic Gaussian control in the operation of multi-reservoir systems, leading to linear release rules. The optimal daily release from each reservoir is given as a linear function of storages of both reservoirs and the preceding-day flows, measured at various points of the river network. Optimalization of the Saylorville Reservoir under drought conditions used inflows represented through a cyclo-stationary (seasonal) Markov chain, and operational graphs were developed giving the optimal semi-monthly release as a function of reservoir storage at the beginning of the drought period. (Zielinski-MAXIMA)

W83-00248

**ANALYSIS OF LEGAL AND INSTITUTIONAL ARRANGEMENTS AFFECTING WATER ALLOCATION AND USE IN NEBRASKA,** Nebraska Univ.-Lincoln. Coll. of Law.

For primary bibliographic entry see Field 6E.

W83-00250

**HO: FOR REESE RIVER NATURAL RESOURCES OF THE TOIVABE-TOQUIMA HIGHLANDS, CENTRAL NEVADA,** Nevada Univ. System, Reno. Desert Research Inst. For primary bibliographic entry see Field 6B.

W83-00253

**PRODUCTION OF REPRODUCTIVELY LIMITED GRASS CARP FOR BIOLOGICAL CONTROL OF AQUATIC WEEDS - PHASE II,** Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.

W. L. Shelton.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108118, Price codes: A05 in paper copy, A01 in microfiche. Alabama Water Resources Research Institute WRRRI Bulletin 45, Auburn University, Auburn, Ala., January, 1982. 64 p, 4 Fig, 7 Tab, 125 Ref. OWRT B-079-ALA(1), 14-34-0001-0201.

Descriptors: \*Grass carp, \*Aquatic weed control, \*Sex reversal (Fish), \*Fish populations, \*Biological

control, Fish food, Fish behavior, Carp, Aquatic weeds, Aquatic plants, Fish stocking, Fish physiology, Steroids, Methyltestosterone.

Use of the grass carp fish offers a useful mechanism for controlling the proliferation of nuisance aquatic plants infesting waterways, providing that unwanted reproduction of the grass carp itself could be controllable. Hence, a study was undertaken to develop a technique for producing grass carp populations with limited reproductive potential. Monosexing through hormone sex reversal was initially tried, but the specialized feeding habits of this fish complicated conventional oral treatment and necessitated an alternate method of steroid exposure. Silastic implantation containing methyltestosterone was the recommended method of hormone administration. Hence, functional sex reversal was used as a means of developing broodstock which, when bred, would yield monosex progeny. Sex-reversed males (genotypic females) were bred in 1980 and 1981; of about 500 offspring from the 1980 class that were sexed, all were females. Also, all gyno-genetic grass carp that were sexed have been females. Further evaluation of the 1980 class and sexing of 1981 class fish will be carried out. It is concluded that, if these offspring are also only female, this monosexing by breeding program can be considered for practical application for control of nuisance aquatic plant growth in waterways. (Zielinski-MAXIMA)

W83-00272

**HIGH PLAINS - OGALLALA AQUIFER STUDY WATER TRANSFER ELEMENT,** Corps of Engineers, Dallas, TX. Southwestern Div.

W. R. Pearson.

In: Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the High Plains, April 1-2, 1982. WRRRI Report No 145, May 1982. p 128-150, 3 Fig, 3 Tab, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.

Descriptors: \*Aquifers, \*Water costs, \*Water transfer, \*Canals, \*Environmental effects, Water distribution, Storage reservoirs, Water courses, Canal construction, Water loss, Pumping plants, Estimated costs, Total costs, Land use, \*Ogallala Aquifer.

This paper presents findings on four alternatives, authorized by the High Plains Study Council, for transferring surplus water into the High Plains region from adjacent areas. The Corps of Engineers determined costs and environmental impacts for the four routes which are roughly identified as: Route A, Nebraska; Route B, Kansas; Route C, Oklahoma; Route D, Texas. The total first costs, including interest during construction, were calculated using 1977 prices, a 9-year authorization/design period, a 15-year construction period, and an interest rate of 7 3/8%. The initial study results indicate that, from an engineering standpoint, a canal system could be constructed to carry up to 9 million acre-feet of water from adjacent areas with first delivery costs ranging from \$3.6 billion for 1.6 million acre-feet of water to Kansas, to \$22.6 billion for 6 million acre-feet to the Texas/Oklahoma panhandle area. Annual cost, which include energy at current prices in 1977 dollars, range from \$413 million for the Kansas route to \$3.8 billion to transport 8.7 million acre-feet to Lubbock, Texas. The unit cost of water delivered to terminal storage in the aquifer goes from \$226 ac/ft to \$569 ac/ft in 1977 dollars. If energy costs increase as expected, the unit cost in 2105 would range from \$320 to \$880 ac/ft. Water losses of 10% have been assumed during transfer. Large amounts of energy would be needed to operate any of the systems, i.e., from 4 to nearly 50 million kilowatt hours per year. Constructing any of these systems would also cause major environmental impacts. Water is available in adjacent areas, but only in-basin surpluses would be considered for export. (Atkins-Omniplan)

W83-00312

**THE ECOLOGICAL EFFECTS OF 2-METHYLTHIOTRIAZINE HERBICIDES USED FOR**

**AQUATIC WEED CONTROL IN NAVIGABLE CANALS, II. EFFECTS ON MACROINVERTEBRATE FAUNA, AND GENERAL DISCUSSION,** Liverpool Univ. (England) Dept. of Botany.

For primary bibliographic entry see Field 5C.

W83-00343

### 4B. Groundwater Management

**THE OGALLALA-HALF FULL OR HALF EMPTY,**

For primary bibliographic entry see Field 6D.

W83-00017

**CARROLL COUNTY GROUND-WATER INFORMATION: WELL RECORDS, SPRING RECORDS, AND CHEMICAL-QUALITY DATA,** Geological Survey, Towson, MD. Water Resources Div.

For primary bibliographic entry see Field 7C.

W83-00058

**GEOHYDROLOGY OF SOUTHWESTERN KANSAS,** Geological Survey, Lawrence, KS. Water Resources Div.

For primary bibliographic entry see Field 7C.

W83-00059

**THE HYDROTHERMAL SYSTEM IN SOUTHERN GRASS VALLEY, PERSHING COUNTY, NEVADA,** Geological Survey, Carson City, NV. Water Resources Div.; and Geological Survey, Menlo Park, CA. Water Resources Div.

A. H. Welch, M. L. Sorey, and F. H. Olmsted.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$28.50 in paper copy, \$4.00 in microfiche. Open-File Report 81-915, 1981. 193 p, 35 Fig, 1 Plate, 18 Tab, 96 Ref.

Descriptors: \*Hydrothermal studies, \*Thermal water, \*Aquifer characteristics, \*Water temperature, Model studies, Structural geology, Hydrologic properties, Geochemistry, Geophysics, Thermal springs, Wells, Water level, Well data, Electric power, Maps, \*Nevada, Pershing County, Southern Grass Valley.

Southern Grass Valley is typical extensional basin in the Basin and Range province. Leach Hot Springs, in the southern part of the valley, represents the discharge end of an active hydrothermal flow system with an estimated deep aquifer temperature of 163-173°C. This report discusses results of geologic, hydrologic, geophysical and geochemical investigations used in an attempt to construct an internally consistent model of the system. (USGS)

W83-00060

**EFFECTS OF EFFLUENT SPRAY IRRIGATION ON GROUND WATER AT A TEST SITE NEAR TARPO SPRINGS, FLORIDA,** Geological Survey, Tallahassee, FL. Water Resources Div.

For primary bibliographic entry see Field 5B.

W83-00068

**GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SOUTH FALLSBURGH-WOODBOURNE AREA, SULLIVAN COUNTY, NEW YORK,** Geological Survey, Albany, NY. Water Resources Div.; and New York State Geological Survey/State Museum, Albany.

For primary bibliographic entry see Field 7C.

W83-00069

**APPROXIMATELY WATER-LEVEL CHANGES IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS 1977-82 AND 1981-82, AND MEASURED COMPACTION 1973-82, IN THE HOUSTON-GALVESTON REGION, TEXAS,**

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Groundwater Management—Group 4B

Geological Survey, Houston, TX. Water Resources Div. For primary bibliographic entry see Field 7C. W83-00075

**WATER RESOURCES OF THE RINCON AND MESILLA VALLEYS AND ADJACENT AREAS, NEW MEXICO,**  
Geological Survey, Albuquerque, NM. Water Resources Div. For primary bibliographic entry see Field 7C. W83-00078

**APPLICATIONS OF DIGITAL MODELING FOR EVALUATING THE GROUND-WATER RESOURCES OF THE 2,000-FOOT SAND OF THE BATON ROUGE AREA, LOUISIANA,**  
Geological Survey, Baton Rouge, LA. Water Resources Div.

L. J. Torak, and C. D. Whiteman, Jr.  
Louisiana Department of Transportation and Development, Baton Rouge, Water Resources Technical Report No 27, 1982. 87 p, 14 Fig, 8 Plates, 8 Tab, 5 Append.

Descriptors: \*Computer models, \*Groundwater, \*Aquifers, \*Potentiometric level, Forecasting, Aquifer characteristics, Groundwater movement, Leakage, Drawdown, Pumping, Groundwater availability, Hydrologic properties, Finite difference methods, Simulation analysis, \*Louisiana, Baton Rouge.

Ground-water pumping at Baton Rouge, La., has lowered the potentiometric surface of the Miocene aquifer known as the '2,000-foot' sand about 430 feet, 1914-79. A three-dimensional, finite-difference, digital-computer model to simulate ground-water flow was developed as a management tool to evaluate effects of possible future variations in pumping on the potentiometric surface of the '2,000-foot' sand. Hydrogeologic factors included in the model are: spatial variations in hydraulic characteristics of the aquifers and confining layers; transient leakage from confining layers and leakage from other aquifers; and restriction of ground-water flow by the Baton Rouge fault. Preliminary models simulating ground-water flow in one, two, and three dimensions were used to evaluate these factors. A parameter-estimation program aided calibration of the model for the period 1914-61. Verification for the period 1962-79 did not require changes to parameter values. Simulations using possible future variations in pumping indicate excessive drawdowns can be averted and relatively stable water levels can be achieved near Baton Rouge if pumping is reduced about 10% from the 1979 rates. Outlying parts of the modeled area show continuing water-level declines, although pumping was reduced by 30%. (USGS) W83-00114

**HYDROLOGIC DATA FOR THE ALLUVIUM AND TERRACE AQUIFER OF THE BEAVER-NORTH CANADIAN RIVER FROM THE PANHANDLE TO CANTON RESERVOIR, NORTHWESTERN OKLAHOMA,**  
Geological Survey, Oklahoma City, OK. Water Resources Div. For primary bibliographic entry see Field 7C. W83-00110

**CHEMICAL AND ISOTOPIC COMPOSITION OF WATER FROM THERMAL AND MINERAL SPRINGS OF WASHINGTON,**  
Geological Survey, Menlo Park, CA. Water Resources Div. For primary bibliographic entry see Field 2K. W83-00112

**DEEP ARTESIAN AQUIFERS OF SANIBEL AND CAPTIVA ISLANDS, LEE COUNTY, FLORIDA,**  
Geological Survey, Tallahassee, FL. Water Resources Div. D. H. Boggess, and T. H. O'Donnell.  
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$4.50 in paper copy,

\$3.50 in microfiche. Open-File Report 82-253, 1982. 32 p, 11 Fig, 4 Tab, 7 Ref.

Descriptors: \*Groundwater, \*Confined aquifers, \*Water supply, \*Water quality, Geohydrology, Aquifer characteristics, Wells, Water level, Pumping, Water management, Water use, Water properties, Saline water intrusion, Chemical analysis, \*Florida, Sanibel Island, Captiva Island.

The principal sources of water on Sanibel and Captiva Islands, Lee County, Florida, are two deep artesian aquifers within the upper and lower parts of the Hawthorn Formation. Both aquifers are under artesian pressure and wells flow at the land surface. Water from the upper aquifer is of better quality than that from the lower aquifer and can be used in some areas without desalination. Dissolved solids concentrations in the upper aquifer average 1,540 milligrams per liter. Water levels in wells in the upper aquifer range from 8 to 15 feet above sea level; most wells flow as much as 15 gallons per minute at land surface. The lower aquifer is the source of the public supply for the islands. Dissolved solids concentrations in the lower aquifer range from 1,700 to 4,130 milligrams per liter and average 2,571 milligrams per liter. From July to November 1977, water levels in the aquifer ranged from 7 to 32 feet above sea level throughout Sanibel-Captiva Islands. In 1977 the average pumping from public supply wells was 1.4 million gallons per day. Pumpage from the artesian aquifers during 1977 was about 690 million gallons. The water is desalinated before distribution. (USGS) W83-00114

**MAP SHOWING THE POTENTIOMETRIC SURFACE OF THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND, SEPTEMBER 1981,**  
Geological Survey, Annapolis, MD. Water Resources Div.; and Geological Survey, Towson, MD. Water Resources Div.

For primary bibliographic entry see Field 7C. W83-00115

**GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SCHENECTADY AREA, SCHENECTADY COUNTY, NEW YORK,**  
Geological Survey, Albany, NY. Water Resources Div.

For primary bibliographic entry see Field 7C. W83-00116

**GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE CORNING AREA, STEUBEN COUNTY, NEW YORK,**  
Geological Survey, Albany, NY. Water Resources Div.

For primary bibliographic entry see Field 7C. W83-00117

**SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES—NEW ENGLAND REGION,**  
Geological Survey, Reston, VA. Water Resources Div.

A. Simott.  
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, \$3.50. Professional Paper 813-T, 1982. 23 p, 8 Fig, 2 Tab, 111 Ref.

Descriptors: \*Groundwater, \*Regional analysis, \*Streams, \*Aquifer characteristics, Aquifer management, Water supply, Groundwater recharge, Groundwater availability, Wells, Water quality, Contamination, Water resources development, Groundwater potential, Coastal Plains, \*New England Region.

The New England Region has a total area of about 62,400 square miles, and includes the States of Maine, New Hampshire, eastern Vermont, most of Massachusetts and Connecticut, all of Rhode Island, and a small part of southeastern New York. The longest stream is the Connecticut River, extending from northern Vermont and New Hampshire southward to Long Island Sound. Ground water in the region occurs in two types of geologic

materials: unconsolidated sedimentary rocks, and consolidated rocks. The most productive unconsolidated sedimentary rocks are sand and gravel of glacial origin. These deposits occur all over Cape Cod and nearby islands in southeastern Massachusetts and in many of the valleys in the region. The consolidated rocks underlie the entire region. They include crystalline igneous and metamorphic rocks, and consolidated sedimentary rocks—shale, sandstone, and limestone and other carbonate rocks. Ground water is derived primarily from precipitation. It can be intercepted for use by pumping from wells (1) before it discharges to the streams as base flow, and (2) before it drains directly into coastal wetlands, bays, Long Island Sound or the ocean. The potential perennial yield of all the aquifers in the region is estimated to be 27.2 billion gallons per day; in addition, at least 105 trillion gallons is estimated to be stored in the aquifers. Withdrawals of fresh ground water in 1975 aggregated about 220 billion gallons, or about 12% of the total freshwater withdrawals of 1,800 billion gallons. In view of the available ground-water reserves, considerable additional water could be developed. (USGS) W83-00120

**DESIGNATION OF PRINCIPAL WATER-SUPPLY AQUIFERS IN MINNESOTA,**  
Geological Survey, St. Paul, MN. Water Resources Div.

For primary bibliographic entry see Field 2F. W83-00125

**ESTIMATED EFFECTS OF PROJECTED GROUND-WATER WITHDRAWALS ON MOVEMENT OF THE SALTWATER FRONT IN THE FLORIDAN AQUIFER, 1976-2000,**  
Geological Survey, Lakewood, CO. Water Resources Div.

W. E. Wilson.

Available from Supt. of Documents, GPO, Washington, DC 20402, Price, \$3.75. Water-Supply Paper 2189, 1982. 24 p, 17 Fig, 2 Tab, 19 Ref.

Descriptors: \*Computer models, \*Groundwater, \*Saline-freshwater interfaces, \*Aquifer characteristics, Drawdown, Potentiometric level, Observation wells, Water level fluctuations, Pumping, Groundwater movement, Water use, Water quality, Phosphates, Mining, Chlorides, Simulation analysis, \*Florida, West-central Florida, Floridan aquifer.

Maps of observed 1976 and simulated 2000 potentiometric surfaces were used to estimate rates of saltwater encroachment and theoretical equilibrium positions of the saltwater-freshwater interface in west-central Florida. The observed 19,000 milligram-per-liter isochlor corresponds closely to a theoretical saltwater-freshwater interface computed by the Ghyben-Herzberg method using heads from a map of the predevelopment potentiometric surface. Average landward flow rate of the saltwater front was computed to be between 0.30 and 0.36 foot per day during the simulation period. Seward potentiometric gradient under simulated October 2000 conditions averaged  $8.8 \times 0.00005$  foot per foot less than under observed September 1976 conditions. Regional observation wells are desirable for monitoring potentiometric-level changes in western Hardee County and eastern Manatee County and for monitoring water-quality changes along the saltwater front. Net landward movement of the saltwater front in the lower part of the Floridan aquifer is probably occurring under existing conditions. Pumping during 1976-2000 would probably increase slightly the rate of movement. However, rates are so slow that, on a regional basis, saltwater encroachment is not a major threat to the freshwater resources. Significant local encroachment could result under certain conditions. (USGS) W83-00130

**TRACING WELL WATER POLLUTION IN A LIMESTONE AQUIFER,**  
Engineering Technology, Inc., New Orleans, LA. For primary bibliographic entry see Field 5B. W83-00173

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4B—Groundwater Management

#### USE OF FRACTURE TRACES IN WATER WELL LOCATION: A HANDBOOK.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108274, Price codes: A04 in paper copy, A01 in microfiche. Office of Water Research and Technology, Washington, D.C., Report OWRT TT/82 1, April 1982. 55 p, 19 Fig, 19 Ref. OWRT C-00016-W (04442).

Descriptors: \*Geologic fractures, \*Groundwater availability, \*Site selection, \*Well water, \*Fracture springs, Contamination, Wells, Soil water, Groundwater, Available water, Fracture permeability, Fault springs, Subsurface water, Subsurface drainage, Surface permeability, Remote sensing, Geohydrology.

Fractures and faults often have subtle surface expressions that reveal their presence; based on this principle, competent well drillers/hydrogeologists/engineers have access to a scientifically-sound indirect means of locating the best spot to drill a successful well. The proper use of this technique, known as fracture trace analysis (FTA) is explained. The technique relies primarily on the use of aerial photographs to delineate the presence of subsurface fractures which may serve as conduits for groundwater flow. Covered are: basic groundwater hydrology; fundamentals of air photo interpretation; field application of fracture traces to water-well location; and the rating of drilling targets. Also considered are factors related to coordination with drilling contractors and hydrogeologic considerations influencing well yields. The FTA procedure sequence involves: assembling topographic/geologic/property maps and available area hydrogeologic data; locating aerial photographs (1:20,000 scale preferred); properly mapping all photolinear features in/adjacent to the area of interest; eliminating all obvious non-geologic linear features; establishing scale and true north direction on the photo; field-checking the photolinear features; and measuring/surveying accurately to the selected point for test/drilling. Specific examples of actual field application of the FTA technique. (Zielinski-MAXIMA)

W83-00217

#### GROUNDWATER IS THE ANSWER TO ZAMBIA'S WATER PROBLEM,

Johnson Screens Europe Office, London (England).

G. W. Burton.  
Water Services, Vol 86, No 1035, p 222, May, 1982. 1 Fig.

Descriptors: \*Groundwater mining, \*Boreholes, \*Water resources development, Groundwater, Pumping tests, Transmissivity, Specific capacity, Potable water, \*Zambia, Africa.

The feasibility of groundwater extraction was investigated in a multiple-storey aquifer system in Zambia, south-eastern Africa. Borehole Peggy was drilled and sixteen hours of development were carried out using the jetting machine technique. Totally sand-free water was obtained after only two hours of airlifting. Test pump data yielded transmissivity estimate of 100 m<sup>2</sup>/d, specific capacity estimate of 73 m<sup>3</sup>/d/m, and radius of influence estimate of 300 m. A conservative production level was estimated to be 19.1 liters/s with a corresponding drawdown of 22.5 m. The borehole results indicated significant resources of potable water in the Mongu area. (Small-FRC)

W83-00225

#### GROUNDWATER IN THE INNER BLUE-GRASS KARST REGION, KENTUCKY,

Kentucky Water Resources Research Inst., Lexington.

For primary bibliographic entry see Field 2F.

W83-00275

#### IRRIGATION SCHEDULING,

Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 3F.

W83-00310

#### 4C. Effects On Water Of Man's Non-Water Activities

#### THE RECENT HISTORIES OF THREE CANADIAN SHIELD LAKES: A PALEOLIMNOLOGICAL EXPERIMENT,

Queen's Univ., Kingston (Ontario). Dept. of Biology.

For primary bibliographic entry see Field 5C.

W83-00042

#### LOW FLOW OF STREAMS IN FAIRFAX COUNTY, VIRGINIA,

Geological Survey, Fairfax, VA. Water Resources Div.

E. H. Mohler, Jr., and G. F. Hagan.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$8.00 in paper copy, \$4.00 in microfiche. Open-File Report 81-63, 1981. 30 p, 8 Fig, 1 Plate, 4 Tab, 14 Ref.

Descriptors: \*Low flow, \*Streams, \*Frequency analysis, \*Urbanization, Streamflow, Flow characteristics, Geology, Flow measurements, Maps, \*Virginia, Fairfax County, Potomac River, Occoquan River.

The effect of geologic differences and urban development on low-flow characteristics of streams in Fairfax County, Va., are discussed. Tables of annual minimum 7-day average flow values for various recurrence intervals are presented for 5 long-term gaging stations and for 37 selected low-flow measurement sites. Drainage-basin boundaries and 7-day 10-year low-flow values are shown on a 1:48,000-scale map of the county. (USGS)

W83-00062

#### HYDROLOGIC DATA FOR URBAN STORM RUNOFF FROM NINE SITES IN THE DENVER METROPOLITAN AREA, COLORADO,

Geological Survey, Lakewood, CO. Water Resources Div.

For primary bibliographic entry see Field 7C.

W83-00077

#### USE OF MATHEMATICAL MODELS TO PREDICT IMPACTS OF MINING ENERGY MINERALS ON THE HYDROLOGIC SYSTEM IN NORTHWESTERN COLORADO,

TRW, Lakewood, Colorado, Energy Engineering Division.

G. J. Saulnier, Jr., and K. E. Goddard.

Mining Engineering, Vol 34, No 3, p 285-293, March, 1982. 11 Fig, 1 Tab, 14 Ref.

Descriptors: \*Hydrologic models, \*Hydrologic systems, Coal mining, Oil shale, Mathematical models, Simulation analysis, Water quality, Groundwater, Geohydrology, Surface water, Prediction, \*Colorado, \*Mining industry.

Increasing development of coal and oil shale resources in northwestern Colorado has focused attention on the potential impacts of such development on the surface and subsurface hydrology of the affected areas. The U.S. Geological Survey has developed mathematical models programmed for digital computers to assess these potential impacts. A quasi-three-dimensional, finite-difference model has been used to simulate the potential impacts of oil shale mining on groundwater hydrology and of hypothetical mine dewatering operations at proposed oil shale mines. A true three-dimensional, solute-transport model was also used to evaluate the effects of flooding in hypothetical abandoned mines. A digital watershed model was used to investigate the potential impacts of coal and oil shale mining on watersheds having snow as the major source of runoff and recharge. A river quality assessment model was used to evaluate the potential impacts of coal development on surface water quality. Application of the models to the Piceance Creek basin in Colorado showed that dewatering operations during development would reduce the discharge in the Creek, that flooding of

abandoned mines would impact negatively on both ground and surface water in the basin, and that most Colorado water quality goals would be met until 1985, although the standards for nonionized ammonia would be exceeded. These models represent an important first step in analyzing the existing data base and predicting impacts and in identifying new data needs. Although the models may not be totally applicable on the local level, they are very meaningful at a regional level. (Carroll-FRC)

W83-00168

#### DRAINAGE AND STRUCTURES.

For primary bibliographic entry see Field 8A.

W83-00334

#### 4D. Watershed Protection

#### SOIL SURVEY OF THE EXPERIMENTAL CATCHMENTS NEAR BETHLEHEM,

Department of Water Affairs, Pretoria (South Africa). Hydrological Research Inst., Pretoria (South Africa).

H. Maaren.

Technical Report No. TR 96, May 1979. 30 p, 9 Fig, 11 Tab, 6 Ref, 4 Append.

Descriptors: \*Catchment basins, \*Soil surveys, \*Soil classification, \*Hydrologic aspects, Catchment areas, Watersheds, Hydrological regime, Hydrologic models, Eutrophication, Saline soils, Soil tests, Soil types, Soil moisture, Topsoil, Subsoil, Chemical analysis, Trace metals, Water analysis, Soil environment, Agricultural watersheds, \*South Africa.

A 1979 soil survey of a 380 sq km catchment was carried out to provide a physically sound basis for studying catchment hydrology. Emphasis was placed on the influence of the soil environment and agricultural land use, while the significance of downslope lateral soil moisture movement and the concept of a variable source were also considered. Field studies were made in which 568 auger observations were taken. Characteristics examined included: geology/topography, vegetation and land use, climatic aspects, soil classifications, and soil effects on catchment hydrology. The catchment topsoil is predominantly orthic with some vertic, while 11 diagnostic horizons occur in the subsoil horizons. Most of the soils are eutrophic. Observations indicated that lateral movement of soil moisture may be expected to perform a significant role in catchment hydrology. Moisture content in soil cores ranged from 11.6-16.1 weight-%. Ancillary trace metal analyses of river and farm seepage samples showed high total salt levels and a medium-high sodium adsorption ratio. Detailed observations are reported concerning soil types. The study results should provide an improved quantitative description of the hydrology of this natural catchment and assist catchment modeling efforts. (Zielinski-MAXIMA)

W83-00087

#### HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1973,

Agricultural Research Center, Beltsville, MD. Hydrologic Data Lab.

For primary bibliographic entry see Field 7C.

W83-00095

#### RELATION OF USLE FACTORS TO EROSION ON RANGELAND,

Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 2J.

W83-00096

#### USE OF EROSION MODELS ON WESTERN RANGELANDS,

Bureau of Land Management, Boise, ID.

For primary bibliographic entry see Field 2J.

W83-00097

## Watershed Protection—Group 4D

**THE USLE RAINFALL FACTOR FOR SOUTHWESTERN U. S. RANGELANDS,**  
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.

J. R. Simanton, and K. G. Renard.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 50-62, 11 Fig, 3 Tab, 10 Ref.

Descriptors: \*Rainfall, \*Soil erosion, \*Rangeland, \*Thunderstorms, \*Erosion index, \*Rainfall intensity, \*New Mexico, \*Arizona, Rainfall impact, Rainfall distribution, Kinetic energy.

Air-mass thunderstorms, occurring primarily during the summer months of July through September, dominate the rainfall/runoff/erosion relationships in much of the rangeland areas of the Southwest. To estimate the erosion associated with such areas, the Universal Soil Loss Equation (USLE) is being used to reflect the climatic variability and the potential erosion due to raindrop impact. The air-mass thunderstorms in the region are typically highly variable in both time and space, of limited areal extent, and of short duration. Data from the experimental watersheds at Safford, Arizona; Albuquerque, New Mexico; Walnut Gulch, Arizona; and Alamogordo Creek, New Mexico, were used to compute the rainfall erosion index (product of the kinetic energy and 30-min maximum intensity) to illustrate the extreme temporal and spatial variability of the USLE rainfall erosion index (EI). Rainfall records from a single recording雨量計 can be used to estimate the EI only for the area within 0.3 mi radius of that point. Because EI computation is based on maximum 30-min rainfall intensity, most of the EI units are derived from the relatively short, high-intensity portion of the thunderstorms. Thus, in thunderstorm dominated rainfall areas such as Arizona and New Mexico, recording雨量計es with depths for short time intervals are needed to compute storm EI. An EI predicting equation that is based on widely available precipitation frequencies was developed for the thunderstorm-dominated regions of Arizona and New Mexico. This equation might also be used in other regions where thunderstorm rainfall dominates the hydrologic and erosion processes. (Moore-SRC)

W83-00098

**EFFECTS OF SLOPE LENGTH AND STEEPNESS ON SOIL EROSION FROM RANGELANDS,**  
Washington State Univ., Pullman.  
For primary bibliographic entry see Field 2J.  
W83-00099

**SPECIAL PROBLEMS IN THE APPLICATION OF THE USLE TO RANGELANDS: C AND P FACTORS,**  
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 2J.  
W83-00100

**A TEST OF THE USLE ON BARE AND SAGEBRUSH PLOTS IN UTAH,**  
Utah State Univ., Logan. Watershed Science Unit.  
G. E. Hart.  
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 101-105, 2 Tab.

Descriptors: \*Rangelands, \*Soil erosion, \*Rainfall intensity, Mathematical models, \*Utah, Slopes, Rainfall simulators, Soil properties, Soil water, Vegetation.

In June 1980 a rainfall simulator was used on eight standard plots (72.6 x 6 feet) to evaluate factors in the Universal Soil Loss Equation (USLE) on rangelands. Two conditions were examined: low intensity rainfall (about 1.1 in/hr for 60 minutes) on dry soil followed by high intensity rainfall

(about 2.2 in/hr for 33 minutes) on very wet soil. The study area is situated about 20 miles northeast of Logan, Utah at an elevation of 6200 feet. The soil is a silt loam, typic argixeroll, a common soil in mountains of northern Utah, and a K value of .32 was assigned from the nomograph using particle-sizes from lab analysis. Four plots were on a gentle slope (11%), and four were on a 32% slope about 100 yards away. Three surface conditions existed on the plots, both on gentle and steep sites: fallow, crusted, and vegetated. Closer prediction of measured soil loss occurred for higher intensity rainfall on previously wetted bare soil than for lower intensity rain on very dry soil. Effects of antecedent moisture can be important and are not taken into account for individual events. Existing tables, or methods, for determining K values and C values (particularly C values in the bare, fallow condition) do not adequately represent wildland soils and cover. The substantial overestimates by the USLE seem mostly attributed to these factors. A major research need is to establish baseline values of soil losses per unit of R under standard conditions of a bare, but uncultivated, surface. (Moore-SRC)

W83-00101

**USE OF RAINFALL SIMULATORS TO DETERMINE PARAMETERS FOR EROSION PREDICTION,**Science and Education Administration, Ames, IA.  
For primary bibliographic entry see Field 2J.  
W83-00102**ESTIMATING SEDIMENT YIELD FROM RANGELAND WITH CREAMS,**

Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 2J.

W83-00103

**MODELING EROSION IN OVERLAND FLOW,**  
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.

L. J. Lane, and E. D. Shirley.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 120-128, 1 Fig, 2 Tab, 17 Ref.

Descriptors: \*Overland flow, \*Soil erosion, \*Mathematical models, \*Rainfall-runoff relationships, Rill erosion, Rainfall impact, Rainfall simulators, Model studies, Sediment yield, Small watersheds, Arizona.

Runoff from upland areas can be accompanied by substantial erosion. Overland flow on upland areas was modeled as overland flow on a plane. Erosion on upland areas is conceptualized as consisting of rill and interrill erosion. Interrill erosion is assumed due to rainfall impact, and rill erosion was defined as erosion due to tractive forces and transport capacity in flow as it occurs in rills or small channels. The combined runoff-erosion process is called overland flow with rill and interrill erosion. Partial differential equations have been formulated for the above runoff-erosion process. Analytic solutions were developed for the general case of rising, equilibrium, and recession hydrographs and for the entire partial-equilibrium hydrograph. The runoff-erosion model was tested using rainfall simulator data. Optimal values of the model parameters were determined for 9 runoff events. Simulation results with the optimal parameters seem to be reasonable approximations (good fit) to observed runoff and concentration data. Sediment yield values computed by the model also seem to be reasonable approximations to observed data. To determine if the coupled runoff-erosion equations might have applications for natural watersheds, data from a small, natural watershed on Walnut Gulch were analyzed. The computed sediment concentration and sediment yield data were consistent with observations on this watershed. The parameter values were logically related to parameters from the experimental plots, and thus, the

procedure may have application to small watersheds. (Moore-SRC)  
W83-00104

**SEDIMENT YIELD FROM SMALL SEMIARID RANGELAND WATERSHEDS,**  
Science and Education Administration, Tucson, AZ.

K. G. Renard, and J. J. Stone.

In: Proceeding of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 129-144, 3 Fig, 6 Tab, 24 Ref.

Descriptors: transport, Runoff, Hydrologic models, Range management, \*Arizona, Experimental watersheds.

Predicting sediment yield in the western United States, despite recent developments in water resource models, is difficult and often subjective. Five sediment yield formulas were tested with sediment yield data from nine small watersheds in the Walnut Gulch Experimental Watershed near Tombstone, Arizona. The methods tested include: the Pacific Southwest Interagency Committee Method (PSIAC), the Dendy/Bolton Method, the Flaxman Method, the Renard Method, and Simulator for Water Resources in Rural Basins (SWRRB) Modified Universal Soil Loss Equation (MUSLE). The PSIAC method appears to give the best results for the amount of work required to make the estimate. The SWRRB/MUSLE method also gave good results, but the amount of work required for the hydrologic portion of the model is considerable. Only the PSIAC and the SWRRB/MUSLE methods allow the use of factors (parameters) that reflect management practices. The Renard method also could be used to reflect management practices if the stochastic runoff model and the sediment transport relationship were used directly. The Flaxman method, as modified in 1974, illustrates some of the improvement which can be obtained by inclusion of an additional term to reflect the 2-yr frequency peak flow. The methods tested generally underpredicted sediment yield. The underprediction may, in part, be associated with the questionable representativeness of the climatic sample for the period of observation. (Moore-SRC)

W83-00105

**PREDICTING SEDIMENT YIELDS FROM SAGEBRUSH RANGELANDS,**  
Science and Education Administration, Boise, ID. Northwest Watershed Research Center.

C. W. Johnson, and K. A. Gebhardt.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 145-156, 5 Fig, 5 Tab, 13 Ref.

Descriptors: \*Sediment yield, \*Rangeland, \*Mathematical models, \*Grazing, \*Sagebrush, \*Idaho, Rangeland management, Environmental Impact Statement, Vegetation, Brush control, Herbicides.

Comparative analysis is a common technique in Environmental Impact Statement preparation, because it shows the effects of alternative action in relation to present conditions or some recognized standard. Generally, there is a lack of on-site field data and, because of the large expense required for information collection, appropriate methods and data must often be extrapolated to the area under consideration. This study shows an application of the Pacific Southwest Inter-Agency Committee (1968) sediment yield prediction procedure (PSIAC) compared with measured yields from sagebrush rangeland areas in southwest Idaho. Predicted yields were within 15% of measured watershed sediment yields and provide a method for comparing and predicting effects of different site conditions and management changes. The equations developed to evaluate individual PSIAC factors are an improvement over subjective narrative method used in the original procedure. Average yearly predicted sediment yields from three Reynolds Creek watersheds by the PSIAC procedure ranged from 1.3 to 2.1 t/ha/yr. Predicted yields on

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4D—Watershed Protection

watershed subareas ranged from 1.0 to 2.7 t/ha/yr in response to PSIAc factor values. Moderate to heavy cattle grazing increased PSIAc estimated sediment yield about 0.2 t/ha/yr, based on differences in vegetative cover on grazed areas and areas that had been ungrazed about 8 years. Extremely heavy cattle grazing increased PSIAc estimated sediment yield 0.32 t/ha/yr. PSIAc estimated sediment yield was only increased about 0.1 t/ha/yr where sagebrush was cut and removed. Sagebrush eradication by spraying had less effect on sediment yield than moderate-to-heavy grazing. (Moore-SRC) W83-00106

#### TESTING THE MODIFIED UNIVERSAL SOIL LOSS EQUATION, Agricultural Research Service, Temple, TX.

J. R. Williams.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 157-165, 4 Tab, 12 Ref.

Descriptors: \*Soil erosion, \*Runoff rates, \*Mathematical models, \*Runoff volume, Erosion control, Storm runoff, Hydrologic models, Slopes, Climate, \*Watershed management.

The Modified Universal Soil Loss Equation (MUSLE) was developed by replacing the rainfall energy factor of the USLE with a runoff energy factor. The MUSLE runoff energy factor is a function of the product of the runoff volume and the peak runoff rate for an individual storm. The MUSLE was tested with data from 102 watersheds located throughout the U.S. These watersheds provided a wide range in watershed and climatic characteristics and management strategies. In tests using measured runoff data, MUSLE generally gave satisfactory results, but two possible deficiencies were discovered: the LS (slope length and steepness) factor may not be adequate for flat slope watersheds; and there may be a tendency for MUSLE to overpredict small storms and underpredict large ones. The runoff energy and erosion control practice factors need attention. MUSLE was linked with an expanded version of the CREAMS daily rainfall hydrology model to provide estimates of the runoff factor. The new hydrology-sedimentation model called SWRRB (Simulator for Water Resources on Rural Basins) shows promising results although some of the tests are not complete. (Moore-SRC) W83-00107

#### DEVELOPING A USLE COVER-MANAGEMENT (C) FACTOR PROCEDURE FOR FOREST CONDITIONS, Forest Service, Atlanta, GA.

G. E. Dissmeyer.

In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 166-186, 11 Fig, 3 Tab, 13 Ref.

Descriptors: \*Soil erosions, \*Forest management, \*Mathematical models, \*Clear-cutting, Canopy, Roots, Ground cover, Storage, Sheet erosion, Rill erosion, Contour tillage, Soil organic matter, Mississippi, Tennessee, North Carolina, South Carolina.

The major subfactors operating in the forest environment are: amount of bare soil, or conversely, ground cover; canopy; soil reconsolidation; high organic content; fine roots; residual binding effect; on-site storage; steps; and contour tillage. A value for the composite C factor is a product of values for each of the subfactors operating in a given forest situation. The procedure for determining the C factor was tested using data from forest research watersheds in northern Mississippi, western Tennessee and North Carolina, and research plots in South Carolina. The forest management conditions included undisturbed, clear-cut, strip cut forest and a variety of site preparation treatments including bedding, chopping, disk, shearing and windrowing, and shearing, windrowing, and seeding

with grass. Results of the validation suggested that the procedure gives reasonable values for the Universal Soil Loss Equation (USLE) factor C for forest conditions. This procedure incorporates many of the factors that affect sheet and rill erosion on forest land and provides a means for evaluating C for a broad range of conditions that could not be accomplished with a classification system. (Moore-SRC) W83-00108

#### LARGE-SCALE BEDFORMS IN THE PLATTE RIVER DOWNSTREAM FROM GRAND ISLAND, NEBRASKA: STRUCTURE PROCESS, AND RELATIONSHIP TO CHANNEL NARROWING,

Geological Survey, Denver, CO. Water Resources Div.

K. D. Crowley.  
Open-File Report 81-1059, 1981. 33 p, 15 Fig, 20 Ref.

Descriptors: \*Rivers, \*Braided streams, \*Channels, \*Sedimentary structures, Channel morphology, Sediment transport, Flow characteristics, Vegetation effects, \*Nebraska, Platte River, Bed forms.

The Platte River channel in Nebraska, especially downstream from Grand Island, is characterized by large, periodic, and geometrically distinct bedforms called macroforms. Macroforms have dimensions commensurate with the width and depth of the channel and are emergent at all but the highest flow stages. The encroachment of vegetation on macroforms and their consequent stabilization since the large-scale development of irrigation in the Platte River basin is the major cause of the reduction in channel width upstream from Grand Island. From simple geometrical considerations of macroform shape, an equation is developed to predict the depth and duration of flow required to erode the stoss sides of the macroforms to remove new vegetal growth each year. The methods developed in this report to eliminate vegetal growth on macroforms may provide a useful management tool for controlling width of the Platte River channels. Although further testing is required to establish the validity of these methods at actual stream sites, a sample calculation for the Silver Creek reach shows good agreement between the flow conditions predicted by the methods developed in this report and actual flow conditions. (USGS) W83-00111

#### PERENNIAL-STREAMFLOW CHARACTERISTICS RELATED TO CHANNEL GEOMETRY AND SEDIMENT IN MISSOURI RIVER BASIN,

Geological Survey, Lawrence, KS. Water Resources Div.

W. R. Osterkamp, and E. R. Hedman.  
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, \$4.75. Professional Paper 1242, 1982. 37 p, 12 Fig, 10 Tab, 42 Ref.

Descriptors: \*Sediments, \*Channel morphology, \*Streamflow, \*Flow characteristics, Perennial streams, Sediment transport, Data collections, Gaging stations, \*Missouri River basin, Channel geometry, Width-discharge relations.

Geometry, channel-sediment, and discharge data were collected and compiled from 252 streamflow-gaging stations in the Missouri River basin. The sites represent the complete ranges of hydrologic and geologic conditions found in the basin. The data were analyzed by computer to yield equations relating various discharge characteristics to variables of channel geometry and bed and bank materials. The equations provide discharge as the dependent variable for the purpose of making estimates of discharge characteristics at ungaged sites. Results show that channel width is best related to variables of discharge, but that reduction of standard errors can be achieved by considering channel-sediment properties, channel gradient, and discharge variability. The channel-material variables do not exert uniform effects on width-discharge relations and, therefore, are considered as sediment-data groups, or stream types, rather than as terms in multiple power-function equations. Relative to streamflow,

narrowest channels occur when streams of steady discharge transport sufficient silt and clay to form stable, cohesive banks but have a small tractive load of sand and coarser sizes. Stable channels also are associated with high channel gradients, which cause high channel roughness and bed and bank armouring by coarse particle sizes. The widest, most unstable channels are found with streams that apparently transport of large tractive load of sand sizes. The downstream rates of change of width with discharge reflect these trends, suggesting that a given bed-material load necessitates a minimum width over which the tractive material can be moved. (USGS) W83-00121

#### THE SPATIAL DISTRIBUTION IN SOUTHERN AFRICA OF RAINFALL EROSION FOR USE IN THE UNIVERSAL SOIL LOSS EQUATION,

Department of Agriculture and Fisheries, Pietermaritzburg (South Africa).  
For primary bibliographic entry see Field 2J. W83-00140

#### SOIL CHARACTERIZATION AND ALTERNATE SHORELINE EROSION CONTROL MEASURES FOR CONSTRUCTED LAKES IN IOWA,

Iowa State Univ., Ames. Dept. of Civil Engineering.

R. A. Lohnes, and B. M. Berg.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108282, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, October 1981. 42 p, 14 Fig, 10 Tab, 37 Ref, 1 Append. OWRT A-074-IA(1), 14-34-0001-0117.

Descriptors: \*Soil classification, \*Erosion control, \*Mathematical models, \*Lake shores, \*Bank erosion, Shore production, Artificial lakes, \*Iowa, Field tests, Soil physical properties, Model studies, Computer models, Design criteria, Shoreline cover, Predictions.

Field observations of eroded lake shoreline profiles and field and laboratory measurements of geotechnical properties of shoreline soils led to development of a shoreline erosion model. The model includes equations which can be used to estimate the potential maximum height of wave-cut cliff. Predictions obtained from the model were compared with measured values in the field, and were found to show reasonable agreement. This model may be the first step for developing a design method whereby shorelines of artificial lakes can be graded to an equilibrium configuration, thereby eliminating/minimizing erosion by wave action. While future field observations may require modification of the model, present observations indicate that active erosion is occurring at all three lake shoreline sites studied, and that these sites have not reached equilibrium. Soil characteristics included soil composition analysis (e.g., sand, clay, gravel, silt), dry weight, moisture, and shear strength. Samples were taken from shorelines of two man-made lakes to compare/contrast shoreline erosion. The lakes examined were Big Creek Lake in Polk County and Prairie Rose Lake in Shelby County. (Zielinski-MAXIMA) W83-00218

#### IIHR DISTRIBUTED PARAMETER WATERSHED MODEL,

Iowa Univ., Iowa City. Iowa Inst. of Hydraulic Research.

For primary bibliographic entry see Field 2E. W83-00269

#### RUNOFF AND SEDIMENTATION POTENTIALS INFLUENCED BY LITTER AND SLOPE ON A CHAPARRAL COMMUNITY IN CENTRAL ARIZONA,

Arizona State Univ., Tempe. Div. of Agriculture Natural Resource Management.

J. H. Brock, and L. F. DeBano.

In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosys-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Identification Of Pollutants—Group 5A

tems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 372-377, 4 Fig, 3 Tab, 19 Ref. 16-882-CA.

Descriptors: \*Chaparral, \*Slopes, \*Surface runoff, \*Sedimentation, \*Litter, Infiltration capacity, \*Arizona, Soil erosion, Erosion control, Watersheds.

The chaparral type is an important watershed resource in Arizona where it covers about 3-1/2 million acres at mid-elevations throughout the central part of the state. Several factors affect the runoff-sedimentation relationships in chaparral, including vegetation cover and density, litter, slope, and the infiltration capacity of the soil. Runoff and sediment was measured for a chaparral community on the Prescott National Forest in the summer of 1979. The cover on the study area was composed mainly of shrub liveoak (*Quercus turbinella*) and Wright mountainmahogany (*Cercocarpus breviflorus*). Simulated rainfall intensities of 12.5 cm/hr were applied to steep, moderate, and gentle sloped plots covered with none, light, moderate and heavy litter. Infiltration capacity was highest (10.8 cm/hr) on heavy litter plots giving low runoff potentials. Highest sediments (1466 kg/ha) were from bare soils. Litter cover significantly reduced sediment losses and decreased runoff potentials. Even small amounts of litter on the surface greatly reduced the onsite erosion potential of these chaparral soils. Treatments in chaparral communities which bare the soil and leave it unprotected should be avoided. (Moore-SRC)

W83-00301

#### ROLE OF FUNGI IN POSTFIRE STABILIZATION OF CHAPARRAL ASH BEDS, Pacific Southwest Forest and Range Experiment Station, Glendora, CA.

P. H. Dunn, W. G. Wells, II, J. Dickey, and P. M. Wohlgemuth. In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 378-381, 2 Tab, 12 Ref.

Descriptors: \*Rain, \*Fires, \*Soil erosion, \*Soil fungi, \*Erosion control, Sediment control, Heat-shock fungi, Watershed management, Rainfall impact, Chaparral, \*California.

Raindrop impact is a major agent of soil erosion, and any reduction in its effectiveness reduces sediment production from burned watersheds. One possible biological approach to reducing raindrop impact erosion is through the use of heat-shock soil fungi, a group indigenous to chaparral. The heat-shock fungi require a period of heating before their spores will germinate, yet the organisms are not thermophilic. The heat-shock fungi in ash bed are adapted to the high ammonium and pH conditions of the ash and are capable of very rapid growth rates. A chaparral soil treated with heat-shock fungi in three combinations was compared to sterile soil to test the ability of the fungi to diminish raindrop impact erosion after fires. Production of rain-splashed sediment was two to three times greater on the sterile soil than on any of the soils with fungi. The natural heat-shock flora reduced the amount of rain-splashed sediment by 40% over the sterile treatment. Enhancement with additional *Aspergillus* *fishchieri* var. *glaber* produced even greater reductions, 45% over the heat-shock fungi treatment and 65% over the sterile soil. (Moore-SRC)

W83-00302

#### ESTIMATING HYDROLOGIC VALUES FOR PLANNING WILDLAND FIRE PROTECTION, For primary bibliographic entry see Field 6B.

W83-00306

### 5. WATER QUALITY MANAGEMENT AND PROTECTION

#### 5A. Identification Of Pollutants

##### DETERMINATION OF PYRAZON RESIDUES IN WATER BY REVERSED PHASE HIGH PERFORMANCE LIQUID CHROMATOGRAPHY,

Alberta Environmental Center, Vegreville, I. Ahmad.

Journal of Environmental Science and Health, Part B, Vol 17, No 3, p 253-263, 1982. 3 Fig, 2 Tab, 10 Ref.

Descriptors: \*High performance liquid chromatography, \*Pyrazon, \*Pollutant identification, \*Chromatography, Separation techniques, Water analysis, Agricultural chemicals, Herbicides.

A reversed phase high performance liquid chromatography method for the quantitative determination of pyrazon residues in water is described. The simple method replaces the traditional liquid-liquid extraction technique by an adsorption-trapping procedure for the extraction of pyrazon. The method is simple and offers average recoveries of 98.1%. The herbicide is detected with ultraviolet at 270 nanometers. The new technique can be used on water samples containing pyrazon concentrations ranging from 2 ppb to 1 ppm. To demonstrate the use of the method a sample of Vermilion River water was taken from a location near St. Joseph's Hospital, Vegreville, Alberta. It was filtered through a 0.45 micron filter and spiked with pyrazon at 25 ppb. The spiked as well as unspiked samples were carried through the procedure. No pyrazon was found in the blank sample. The recovery of pyrazon from the spiked sample was 94.6%. The pyrazon peak occurred at 6.50 min. Other peaks were present in the sample due to some unknown impurities in water. (Geiger-FRC)

W83-00014

##### ADSORPTION OF PAH TO AQUATIC HUMUS,

Norwegian Inst. for Water Research, Oslo (Norway).

For primary bibliographic entry see Field 5B.

W83-00038

##### DIFFERENTIAL PULSE POLAROGRAPHY OF SOME HERBICIDES DERIVED FROM 2,4-DICHLOROPHOXYACETIC ACID, II. DETERMINATION OF HERBICIDE RESIDUES IN IRRIGATION WATERS,

Kernforschungsanstalt Juelich G.m.b.H. (Germany, F.R.), Inst. fuer Chemie. A. Lechien, P. Valenta, H. W. Nurnberg, and G. J. Patriarche.

Fresenius' Zeitschrift fuer Analytische Chemie, Vol 306, No 2-3, p 156-160, 1981. 8 Fig, 2 Tab, 11 Ref.

Descriptors: \*Pollutant identification, \*Herbicides, \*Polarographic analysis, Pesticides, \*Irrigation water, Water analysis, \*Halogenated pesticides, Farm wastes, Separation techniques, \*West Germany, \*Polarography, Organic acids.

A technique was developed for the differential pulse polarographic analysis of 2,4-D, 2,4-*DP*, MC<sub>PA</sub>, and MC<sub>PP</sub> residues in irrigation waters. Acidified water samples were extracted into chloroform and back extracted into alkali solution. After a final extraction into chloroform, the residues were nitrated and the herbicide concentration was determined by differential pulse polarography. The detection limits were 30 micrograms/liter for 2,4-D and MC<sub>PA</sub> and 40 micrograms/liter for 2,4-*DP* and MC<sub>PP</sub>. Herbicide recoveries ranged from 94.7 to 100%. The present method may also be applied to the analysis of mixtures of 2,4-D and 2,4-*DP* and of MC<sub>PA</sub> and MC<sub>PP</sub>. The sensitivity of the differential pulse polarographic method compared favorably with that offered by other

methods such as gas chromatography. (Geiger-FRC)

W83-00045

##### DETERMINATION OF ORGANOPHOSPHORUS AND ORGANOSULPHUR AT THE SUB-NG-LEVEL FOR USE IN WATER ANALYSIS,

Utrecht Rijksuniversiteit (Netherlands). Analytical Chemistry Lab. L. M. Puijker, G. Veenendaal, H. M. J. Janssen, and B. Griepink.

Fresenius' Zeitschrift fuer Analytische Chemie, Vol 306, No 1, p 1-6, 1981. 5 Fig, 2 Tab, 7 Ref.

Descriptors: \*Pollutant identification, \*Phosphorus, \*Sulfur, Phosphorus compounds, \*Organic compounds, Nutrients, Water analysis, Sulfur compounds, Separation techniques, Flame photometry, Chromatography, Photometry, \*Organophosphates, \*Organosulfates.

A method is described for the determination of organophosphorus and organosulfur compounds in water. Organic compounds are separated from the aqueous sample either by adsorption on XAD resin followed by desorption with methanol or by direct extraction into an organic solvent. The organic solution which results is brought into the hot zone of a heated quartz tube and is flushed with hydrogen. Reaction products are collected in a cold trap which is afterwards heated to 150-200 C. PH<sub>3</sub>, H<sub>2</sub>S and other compounds are separated at room temperature on a chromatographic column. Phosphorus and sulfur are detected by flame photometry down to traces as low as 0.1 and 1 nanogram, respectively. The time for each determination, excluding the isolation procedure, was less than 30 min. (Geiger-FRC)

W83-00046

##### DETERMINATION OF BORON IN RIVER WATER WITH FLAMELESS ATOMIC ABSORPTION SPECTROMETRY (GRAPHITE FURNACE TECHNIQUE),

Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).

R. P. van der Geugten.

Fresenius' Zeitschrift fuer Analytische Chemie, Vol 306, No 1, p 13-14, 1981. 1 Fig, 1 Tab, 7 Ref.

Descriptors: \*Pollutant identification, \*Boron, \*Cations, \*Atomic absorption spectrophotometry, Calcium, Magnesium, Rivers, Water analysis, \*Spectrophotometry, Photometry, Flame photometry.

A simple and rapid technique for the determination of boron (B) in river water by flameless atomic absorption spectrophotometry is presented. The water sample is acidified to pH 2 with nitric acid. To a 100 ml sample, 2 ml of magnesium/calcium solution (10 g/liter Mg, 5 g/liter Ca) is added before spectrophotometric analysis. B levels up to 250 micrograms/liter may be determined with a detection limit of 20 micrograms/liter. The limited working range of 250 micrograms/liter is probably the result of increased carbon-boron interactions at higher concentration levels, resulting in a low reproducibility of signals. The mean standard deviation is 6 + or - 4 micrograms/liter. The effect of several other cations on the B signal is discussed. (Geiger-FRC)

W83-00047

##### AN APPRAISAL OF SURFACE-WATER QUALITY IN THE ALAMEDA CREEK BASIN, CALIFORNIA, OCTOBER 1974-JUNE 1979,

Geological Survey, Menlo Park, CA. Water Resources Div.

For primary bibliographic entry see Field 5B.

W83-00064

##### QUALITY OF SURFACE WATER AT SELECTED SITES IN THE SUWANNEE RIVER BASIN, FLORIDA, 1980,

Geological Survey, Tallahassee, FL. Water Resources Div.

For primary bibliographic entry see Field 7C.

W83-00113

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

#### WATER-QUALITY CHARACTERISTICS OF SIX SMALL, SEMIARID WATERSHEDS IN THE GREEN RIVER COAL REGION OF COLORADO,

Geological Survey, Lakewood, CO. Water Resources Div.

J. T. Turk, and R. S. Parker.

Available from the National Technical Information Service, Springfield, VA 22161 as PB82-207390, Price codes: A06 in paper copy, A01 in microfiche.

Water-Resources Investigations 81-19, 1982. 96 p, 6 Fig, 8 Tab, 10 Ref.

Descriptors: \*Water quality, \*Small watersheds, \*Mineralogy, \*Data collections, Statistical analysis, Trace metals, Streams, Geochemistry, Coals, Strip mine wastes, Baseline studies, Regional analysis, \*Colorado, Green River coal region.

Analysis of major and trace constituents in streams flowing through six semiarid watersheds indicates that the stream chemistry is characterized by saturation with respect to common carbonate minerals (calcium, magnesium, iron, manganese, and lead). The solubility of the carbonate minerals may be a major control on the absolute and relative concentrations of calcium, magnesium, bicarbonate, iron, manganese, and lead; however, other mechanisms probably control the concentrations of cadmium and zinc. Statistical analyses indicate that the mean concentrations of the major ions in the two climatic areas studied are significantly ( $P=0.05$ ) different from one another, with larger mean concentrations in the more arid area. Trace-metal concentrations were similar from one area to another and indistinguishable from site to site ( $P=0.05$ ) for lead, cadmium, and zinc. Linear regressions of major ion concentration to specific conductance are similar in both areas for sodium, bicarbonate, sulfate, and chloride. Results of the study may be useful in providing a first approximation of stream chemistry in other watersheds with the same geologic setting, determining watersheds with similar geochemical controls, and determining future changes in stream chemistry in the watersheds studied. (USGS) W83-00124

#### METHODS FOR COLLECTION AND ANALYSIS OF GEOPRESSURED GEOTHERMAL AND OIL FIELD WATERS,

Geological Survey, Menlo Park, CA. Water Resources Div.

For primary bibliographic entry see Field 2K. W83-00127

#### WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1981—VOLUME 3. WESTERN NEW YORK,

Geological Survey, Albany, NY. Water Resources Div.

For primary bibliographic entry see Field 7C. W83-00131

#### WATER RESOURCES DATA FOR NORTH CAROLINA, WATER YEAR 1981.

Geological Survey, Raleigh, NC. Water Resources Div.

For primary bibliographic entry see Field 7C. W83-00132

#### CHEMICAL SURVEILLANCE OF RIVERS,

Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.

J. S. Fenlon, and D. D. Young.

Water Pollution Control, Vol 81, No 3, p 343-357, 1982. 5 Fig, 3 Tab, 7 Ref.

Descriptors: \*Monitoring, \*Rivers, \*Sampling, Chemical analysis, Water quality, \*Pollutant identification, Automation, Biological oxygen demand, Dissolved oxygen, Suspended solids, Ammonia, Severn-Trent Water Authority, \*United Kingdom.

The development and the objectives of chemical surveillance of river water quality in the United Kingdom are reviewed. Little river water quality monitoring was carried out before 1950. Four national and 2 supplemental surveys were performed

in 1958-1980. A successful sampling scheme must begin with well-defined objectives. Some of these include detection of pollution, identification of trends, assessment of compliance with statutory requirements, and information for decisions. Choice of substances to be monitored depends on the objectives and legal requirements. Most common are BOD, suspended solids, ammonia, dissolved oxygen, pH, temperature, total organic nitrogen, chloride, hardness, and electric conductivity. Manual monitoring provides a wide spectrum of analyses at infrequent intervals; instrumental monitoring provides a continuous record for a few determinants, not including BOD. The Severn-Trent Water Authority sampling program is described. (Cassar-FRC) W83-00134

#### SEASONAL CHANGES OF DISSOLVED SODIUM IN THE CONNECTICUT RIVER NEAR NORTHFIELD, MASSACHUSETTS,

Massachusetts Univ., Amherst. School of Health Sciences.

For primary bibliographic entry see Field 5B. W83-00139

#### BIOASSAY TECHNIQUE FOR RELATIVE TOXICITY IN WATER POLLUTION CONTROL,

Texas Univ. at Dallas.

A. W. Busch.

Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1152-1154, July, 1982. 4 Fig, 12 Ref.

Descriptors: \*Pollutant identification, \*Biological oxygen demand, \*Toxicity, \*Bioassay, Water pollution effects, Bacteria, Copper, Cyanides, Detergents, Water pollution control.

The BOD bottle bacterial test system is reintroduced as a method for determining relative toxicity of low concentrations of substances or effluents. By establishing benchmark responses for known toxicants such as copper, cyanide, and cadmium, in parallel, simultaneous tests, the relative toxicity of the test substance may be assessed. Although this technique needs further refinement, it deserves reevaluation because it is simple and direct, the bacteria are ubiquitous and easy to control, respiration and assimilation can be studied, both acute and chronic toxicity may be assessed, and capital costs are low. Examples of the procedure's use in determining toxicity of copper, cyanide, and alkyl benzene sulfonates are given. (Cassar-FRC) W83-00146

#### MULTIPLE PURGE TECHNIQUES FOR DETERMINING ORGANIC POLLUTANTS IN GROUNDWATER,

Connecticut Agricultural Experiment Station, New Haven.

R. P. Kozlowski, and B. L. Sawhney.

Bulletin of Environmental Contamination and Toxicity, Vol 29, No 1, p 1-6, 1982. 2 Fig, 1 Tab, 3 Ref.

Descriptors: \*Groundwater pollution, \*Gas chromatography, \*Landfills, \*Organic loading, Water pollution, Garbage dumps, Alcohols, Ethyl chloride, Acetone, Isopropanol, Diethyl ether, Methyl ethyl ketone, 2-Butanone, Benzene, Methyl isobutyl ketone, Toluene, Ethyl benzene, Solubility.

A procedure for analyzing volatile organic pollutants in groundwater by using the gas chromatography purge and trap method is described. Groundwater samples were collected from test wells. Retention times and successive purge ratios were determined using two different columns. The compounds were identified by comparing their retention times with those of standards. A sample collected near a landfill site indicated the presence of ten compounds: ethyl chloride, acetone, isopropanol, diethyl ether, methyl ethyl ketone, 2-butanone, benzene, methyl isobutyl ketone, toluene, and ethyl benzene. The technique showed constant peak ratios for various organic compounds, including a number of alcohols, ketones, and chlorinated hydrocarbon standards. The technique is useful for confirming the identity of GC peaks, the purity of

peaks, and possible alterations in the solubility of trace organics. (Small-FRC) W83-00158

#### ASSOCIATION STUDIES OF POLYBROMINATED BIPHENYLS IN AQUATIC SYSTEMS,

Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.

For primary bibliographic entry see Field 5B. W83-00160

#### CHARACTERIZATION OF ORGANIC CONTAMINANTS IN ENVIRONMENTAL SAMPLES ASSOCIATED WITH MOUNT ST. HELENS 1980 VOLCANIC ERUPTION,

Geological Survey, Denver, CO; and Bureau of Reclamation, Denver, CO. Denver Federal Center.

W. E. Pereira, C. E. Rostad, H. E. Taylor, and J. M. Klein.

Environmental Science and Technology, Vol 16, No 7, p 387-396, July, 1982. 8 Fig, 5 Tab, 32 Ref.

Descriptors: \*Volcanoes, \*Organic compounds, \*Pollutant identification, Water pollution sources, Surface water, Organic matter, Pyrolysis, Hydrocarbons, Fatty acids, Organic acids, Aromatic compounds, Pulp and paper industry, Sediments, \*Mt. St. Helens, Spirit Lake, Coldwater Creek, \*Washington.

Volcanic ash, surface water, and river bottom sediments collected near Mt. St. Helens after the May 18, 1980, eruption were analyzed for organic compounds by capillary gas chromatography-mass spectrometry computer techniques. Alkanes, aromatic and polycyclic aromatic hydrocarbons, alcohols, fatty acids, dicarboxylic acids, ketones, aromatic acids, aldehydes, phenols, chlorinated aromatics, resin acids, terpenes, and insect juvenile hormones were identified. A total of 84 compounds were qualitatively identified in the ash, 42 in the bottom sediments, 73 in Spirit Lake water, and 71 in Coldwater Creek water. Nineteen compounds were common to both water samples. Many of these compounds, commonly found in pulp and paper mill effluents, adversely affect fish, insects, and other aquatic life, and cause oxygen depletion and taste and odor problems in streams. The most likely source of these compounds is the pyrolysis of plant and soil organic matter during and after the eruption. Although these hydrophilic compounds pose a potential groundwater contamination threat, no pollution has yet been detected in monitoring wells. (Cassar-FRC) W83-00161

#### DETERMINATION OF BENZIDINES BY GAS CHROMATOGRAPHIC SEPARATION OF DERIVATIVES WITH ELECTRON CAPTURE DETECTION,

Cincinnati Univ., OH. Dept. of Mechanical Engineering.

F. K. Kawahara, J. R. Dunn, R. A. Fiume, and P. J. McCullough.

Analytica Chimica Acta, Vol 138, p 207-220, 1982. 5 Fig, 3 Tab, 20 Ref.

Descriptors: \*Wastewater analysis, \*Water analysis, Organic compounds, \*Pollutant identification, \*Gas chromatography, Amines, Carcinogens, Aromatic compounds, \*Benzidines.

A method for determining toxic, water soluble benzidines in wastewater used electron capture gas chromatography of the pentafluoropropionamide (PFP) derivatives. Wastewater and tap water spiked with benzidine were reacted with N-pentafluoropropionyl-imidazole to obtain stable derivatives. A 10,000-fold excess of reagent was used. Several derivatization methods were tried and found less satisfactory than PFP imidazole. These were trifluoroacetic acid, N-methyl-bis(trifluoroacetamide), and N-trifluoroacetyl-imidazole. The extraction of water samples was done at pH 8.10 using chloroform or methylene chloride. Overall recovery efficiencies were 91-103%. Four benzidine congeners were readily separated: the PFP derivatives of benzidine, dichlorobenzidine, o-tol-

## Identification Of Pollutants—Group 5A

dine, and dianisidine. Detection limits were 50 fg. (Cassar-FRC)  
W83-00182

**AN OVERVIEW OF ACID RAIN MONITORING ACTIVITIES IN NORTH AMERICA,**  
Flow General, Inc., McLean, VA.  
For primary bibliographic entry see Field 5C.  
W83-00189

**DETERMINATION OF IRON IN NATURAL WATERS AND PLANT MATERIAL WITH 1,10-PHENANTHROLINE BY FLOW INJECTION ANALYSIS,**

Centro di Energia Nuclear na Agricultura, Sao Paulo (Brazil).  
J. Mortatti, F. J. Krug, L. C. R. Pessenda, E. A. G. Zagatto, and S. S. Jorgensen.  
Analyst, Vol 107, No 1275, p 659-663, June, 1982.  
2 Fig, 1 Tab, 9 Ref.

Descriptors: \*Iron, \*Pollutant identification, \*Water analysis, Metals, Heavy metals, \*Flow injection analysis, \*Spectrophotometry, Phenanthroline.

Total iron in natural waters was determined by the ascorbic acid with 1,10-phenanthroline method and flow injection analysis. The absorbance of the orange red complex, formed within a pH range of 2-9, was measured at 512 nm in a spectrophotometer equipped with a flow-through cuvette. A mixing coil length of 50 cm yielded good precision at a sampling rate of 150-180 determinations per hour for 500 microliter samples. At Fe concentrations of 1-5 ppm no interferences were produced from phosphate at 600 ppm, Cu at 20 ppm, Zn at 20 ppm, Al at 100 ppm and Co at 10 ppm. Ag at 10 ppm and Ni at 10 ppm interfered slightly. Sampled by the flow injection technique and by atomic absorption spectrometry produced excellent agreement within 1% relative standard deviation. For a 500 microliter sample volume and a 0.10-10.0 ppm Fe concentration, the detection limit was 0.02 ppm. (Cassar-FRC)  
W83-00194

**PRE-CONCENTRATION TECHNIQUE FOR COLD-VAPOUR ATOMIC-FLUORESCENCE DETERMINATION OF MERCURY IN DRINKING WATERS,**

Severn-Trent Water Authority, Malvern (England), Malvern Regional Lab.  
M. P. Bertenshaw, and K. Wagstaff.  
Analyst, Vol 107, No 1275, p 664-672, June, 1982.  
3 Fig, 5 Tab, 26 Ref.

Descriptors: \*Mercury, \*Sample preparation, \*Water analysis, \*Pollutant identification, Sample preservation, Metals, Heavy metals, Drinking water, Fluorescence, Trace levels, Atomic fluorescence spectroscopy, \*Spectroscopy, Raw water.

A sample preconcentration step using a potassium permanganate solution trap permitted use of the cold vapor atomic fluorescence method for determination of inorganic and total mercury at levels from 1.6 to 700 ng per liter Hg in raw and potable waters. The preconcentration step, which required 250 ml of sample, took only 5 min per test. The trap solution was 1% m/V KMnO<sub>4</sub> in 5% V/V nitric acid with 0.1% m/V potassium dichromate, prepared fresh each day. Argon gas was bubbled through the water sample to purge the Hg into the trap solution. Standard deviation was < 2 ng per liter or 7% of the concentration. Organomercury complexes were made available for determination by digestion with potassium persulfate. Samples, containing ng levels of Hg, preserved with 0.01% m/V potassium dichromate and nitric acid (5% V/V), were stable for at least a week. (Cassar-FRC)  
W83-00195

**ACCURACY OF DETERMINATION OF AMMONIACAL NITROGEN IN RIVER WATERS: ANALYTICAL QUALITY CONTROL IN THE HARMONISED MONITORING SCHEME.**

Water Research Centre, Marlow (England).  
Analyst, Vol 107, No 1275, p 680-688, June, 1982.  
5 Tab, 8 Ref.

Descriptors: \*Quality control, \*Ammonia, \*Monitoring, Nitrogen compounds, Water analysis, Pollutant identification, Laboratories, Water quality, Rivers, Natural waters, \*England, \*Wales, \*Scotland.

The procedures and results of an analytical quality control scheme in England, Scotland, and Wales are described. Eleven laboratories were involved in measuring ammonia concentrations < 0.1 mg per liter. One laboratory used a procedure involving distillation of ammonia and subsequent spectrophotometric determination with Nessler's reagent. All others used a semi-automated continuous flow spectrophotometric system based on formation of indophenol blue. Samples tested were 2 standard solutions, river water, and river water spiked with a known amount of ammonium chloride. The between-laboratory bias test were as follows: standard solution A, 1.70-1.98 mg per liter N obtained, 1.84 mg per liter expected; spiked river water B, 0.22-0.27 mg per liter obtained, 0.24 mg per liter expected; spiked river water C, 4.54-5.03 mg per liter obtained, 4.80 mg per liter expected. Thus biases were -11.3 to +9.2% for the individual laboratories. Targets were total errors of not greater than + or - 20% of the ammonia concentration or 0.1 mg per liter N, whichever was larger. (Cassar-FRC)  
W83-00196

**DETERMINATION OF ORGANIC CONTAMINANTS IN ULTRA-PURE WATER BY REVERSED-PHASE HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH ULTRAVIOLET DETECTION,**  
Berne Univ. (Switzerland). Inst. for Inorganic, Analytical and Physical Chemistry.

J. B. Reust, and V. R. Meyer.  
Analyst, Vol 107, No 1275, p 673-679, June, 1982.  
5 Fig, 12 Ref.

Descriptors: \*Organic compounds, \*Water purification, \*Pollutant identification, Ultrafiltration, Distillation, Ultraviolet radiation, Liquid chromatography, Water analysis, Water pollution sources, \*Chromatography.

Organic impurities were determined in water using high performance liquid chromatography on reversed phase columns with ultraviolet detection at 210 nm and at 254 nm. Water samples included Tap (from Berne, Switzerland), Ioxex (deionized tap water), Bi (doubly distilled Ioxex water), Tetra (Ioxex water distilled 4 times), Ultra (subjected to several purification steps including reverse osmosis, activated carbon adsorption, ion exchange, and ultrafiltration), and Baker (commercial organic-free water). Quality of Tetra and Baker waters were similar using both wavelengths. Ioxex, Bi, and Ultra showed considerable organic contamination using the 210 nm wavelength. Taking samples at different stages of the water purification processes allowed identification of the contaminant sources such as plastic tubing, glues, and housing material, in the purification systems. Sample handling techniques also contributed to organic contamination, including the use of open containers, lengthy sampling time (12 hours), and adsorption at the electrode surface in electrochemical procedures. (Cassar-FRC)  
W83-00202

**COMPARISON OF SULFIDE-SELECTIVE ELECTRODE AND GAS-STRIPPING MONITORS FOR HYDROGEN SULFIDE IN EF-FLUENTS,**

Atomic Energy of Canada Ltd. Chalk River (Ontario). Chalk River Nuclear Lab.  
J. Guleen, H. D. Herrington, J. W. Thorpe, G. Mainprize, and M. G. Cooke.  
Analytica Chimica Acta, Vol 138, p 55-63, 1982. 4 Fig, 1 Tab, 21 Ref.

Descriptors: \*Hydrogen sulfide, \*Wastewater analysis, \*Monitoring, \*Pollutant identification, Sulfides, Effluents, Industrial wastewater, Heavy water, Measuring instruments, Field tests.

Two hydrogen sulfide monitors were tested in continuous field operation at the Glace Bay Heavy

Water Plant, Nova Scotia, over a 6-month period. They were the Orion Model 1516 monitor, based on the direct measurement of potential difference between a sulfide-selective electrode and a pH electrode, and the gas stripping monitor, which used a solid state sensor to detect H<sub>2</sub>S stripped from solution by an air-Cu<sub>2</sub> mixture. The detection limit for both monitors was < 0.005 mg per kg. Both were simple to operate, calibrate, and maintain over the June to December outdoor field tests. Qualitative agreement between the 2 monitors was good. However, there were several occasions on which only one monitor responded to H<sub>2</sub>S excursions. Malfunctions were a result of oxidation of sulfide at the electrode surface by chlorine present in the effluent, presence of suspended solids and oils (up to 50% error), wetting of the solid state sensor, and a several days' period of no H<sub>2</sub>S exposure (decreased sensitivity of sensor). The gas stripping monitor, more tolerant of dirty samples than the Orion monitor, required daily adjustment of flow rates. The Orion monitor was less sensitive to sample flow rates and pH changes below pH 5. (Cassar-FRC)  
W83-00204

**IMPROVEMENTS IN QUANTIFYING THE PHOSPHORUS CONCENTRATION IN LAKE WATER,**

Alberta Univ., Edmonton. Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W83-00208

**MINERALIZATION OF LINEAR ALCOHOL ETHOXYLATES AND LINEAR ALCOHOL ETHOXY SULFATES AT TRACE CONCENTRATIONS IN ESTUARINE WATER,**  
Procter and Gamble Co., Cincinnati, OH. Environmental Safety Dept.

For primary bibliographic entry see Field 5B.  
W83-00211

**COMPONENTS CONTRIBUTING TO LIGHT EXTINCTION IN NATURAL WATER: METHOD OF ISOLATION,**  
Southern Illinois Univ. at Carbondale. Dept of Botany.

J. Verdun.  
Archiv fur Hydrobiologie, Vol 93, No 3, p 303-312, February, 1982. 2 Fig, 2 Tab, 15 Ref.

Descriptors: \*Suspended solids, \*Chlorophyll, \*Light penetration, Lakes, Light extinction coefficient, Pigments, Organic matter, Photosynthesis, Respiration, Dissolved oxygen, Oxygen, Phytoplankton, \*Lambert-Beer's Law, Carbon dioxide, Water analysis, \*Pollutant identification.

The Lambert-Beer's Law relating light extinction to depth and concentration of light-quenching substances is reviewed. The light extinction coefficient (K) can be divided into 3 components: the suspensoid contribution (K<sub>s</sub>), the dissolved pigment contribution (K<sub>p</sub>), and the water contribution (K<sub>w</sub>). The suspensoid fraction can be subdivided into: chlorophyll-correlated (SChl), non-chlorophyll-related organic matter (So), and inorganic (Si). The components were estimated by determining the dry weight of suspensoids and the carbon:chlorophyll regressions which isolate the non-chlorophyll related carbon as the first term in the regression equation. K<sub>s</sub> was equal to 0.12 sq m per g on the average. K<sub>a</sub> and K<sub>p</sub> were responsible for a small fraction of the total light extinction. The So fraction accounted for a considerable proportion of total suspensoids in lakes with low or high photosynthetic rates. Lakes with high relative So are likely to have an excess of respiration over photosynthesis, producing water supersaturated with CO<sub>2</sub> and undersaturated in dissolved oxygen. Lakes with a high relative Si are usually severely light limited. Those with dominant SChl are likely to have a high ratio of photosyntheses to respiration with high pH and oxygen supersaturation. (Cassar-FRC)  
W83-00213

**HAZARDOUS POLLUTANT ANALYSIS IN WATER USING INFRARED SPECTROSCOPY,**

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

Connecticut Univ., Storrs. Inst. of Water Resources.  
C. P. Anderson, and A. P. Bentz.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108373, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, March 1982. 21 p., 11 Fig. 5 Tab. OWRT-A-080-CONN(2), 14-34-0001-0107.

Descriptors: Pollutants, \*Hazardous materials, \*Water analysis, \*Organic compounds, \*Infrared spectroscopy, \*Chemical analysis, Water pollution, Water pollution control, Volatility, Spectral analysis, Spectrometers, Spectrophotometry, Isolation, Thin-layer chromatography, Computers, Libraries, Information retrieval, \*Pollutant identification.

A simple procedure involving an extraction-concentration method followed by computer infrared (IR) spectral enhancement was developed which provides detection and identification of organic pollutant compounds of moderate-to-low volatility in estuarine and coastal waters, down to 1-10 ppm (depending on the IR absorptivity of the compounds). The procedure produces IR spectra of adequate quality for pollutant identification by a computer spectral library search. This method of identification is appropriate provided that other organic pollutants are not present in equivalent concentrations and that background levels of dissolved organics (e.g., petroleum products, fish oil) do not exceed levels commonly found in the Thames River or Fishers Island Sound. In instances where samples involve multiple pollutants or high natural background levels, a thin-layer chromatography (TLC) technique was found to provide adequate separation and cleanup. The TLC separation-cleanup approach also afforded the ability for extension of detection limits for the pollutants downwards to about 100 ppb to 1 ppm, requiring a slight cost for additional sample preparation. It was concluded that IR spectroscopy can be used to identify waterborne organic compounds at about 500 ppb, and detect them in the range of 100 ppb. Water salinity in such samples is not a factor in the extraction of the compounds. Since IR can be used for nonvolatile compounds, it is a natural complement to gas chromatographic techniques. (Zielinski-MAXIMA) W83-00231

#### THE CHEMICAL COMPOSITION OF WATER AND THE ANALYTICAL CHEMIST: A CHALLENGE,

Hydrological Research Inst., Pretoria (South Africa).

W. H. J. Hattingh.

Technical Report No 85, 1979. 10 p., 7 Fig., 8 Tab., 31 Ref.

Descriptors: \*Water analysis, \*Chemical analysis, \*Chromatography, \*Spectroscopy, \*Pollutant identification, Chemical wastes, Water quality, Water sampling, Sample preparation, Sample preservation, Sampling, Heavy metals, Trace elements, Spectral analysis, Detergents, Pesticides, Public health, Inorganic compounds, Organic compounds, Chemical composition, Water pollution.

Advances in analytical tools available to the chemist over the past 25 years for analysis of the chemical composition of water samples are reviewed. Particular emphasis is placed on current analytical capabilities and in the increased complexity in water contaminants. Contaminants covered include synthetic detergents, pesticides, chemicals used in water purification, and various inorganic and organic contaminants. Modern analytical techniques for inorganic water constituents are atomic absorption (including inductively-coupled plasma), automated colorimetric analysis, and selective membrane electrodes; for organic water constituents, capillary gas chromatography (GC) with element-specific detectors, GC-Fourier transform/infrared spectroscopy, GC-mass spectrometry, and high pressure liquid chromatography; and, for broad analytical use, the minicomputer for real-time data collection and reduction. Most analytical techniques for inorganic constituents may be automated and minicomputer-linked; as a result, analyses have increased 11-fold (2435 to over 27,000 per chemist) over the past six years. For organic con-

stituents, the development of more sensitive techniques has also resulted in a rapid increase in compounds detected. Water quality standards relative to inorganic and organic contaminants are also reviewed. (Zielinski-MAXIMA) W83-00290

#### DETERMINATION OF BENZIDINES IN INDUSTRIAL AND MUNICIPAL WASTEWATERS,

Battelle Columbus Labs., OH.

R. M. Riggan, and C. C. Howard.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-196320, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency, Project Summary EPA-600/S4-82-022, May 1982. 5 p., 1 Tab. 68-03-2624.

Descriptors: \*Pollutant identification, \*Water analysis, \*Benzidines, \*Water analysis, \*Chromatography, \*Dye industry wastes, Chemical analysis, Effluents, Sample preservation, Industrial wastewater, Municipal wastewater.

A method for the determination of benzidine and 3,3'-dichlorobenzidine (DCB) in wastewater was developed. This method, based on the use of high performance liquid chromatography with electrochemical detection, is selective for readily oxidized, basic compounds, and can detect as little as 0.1 ppb of benzidine and DCB in many types of aqueous samples, including surface water, municipal sewage, and industrial effluent samples. However, several dye plant effluents contained many oxidizable materials which decreased the sensitivity of the method to about 1 ppb for benzidine and DCB. Apparent levels of 10-20 ppb of benzidine were present in the dye plant effluents. For one dye plant, effluent benzidine was determined to be 9 ppb and 12 ppb using two different sets of chromatographic conditions thus supporting the belief that benzidine is present at the level stated. Precision and accuracy of the method were estimated from five wastewater samples spiked at levels between 1 and 50 ppb. For this group of samples the recoveries were 69 + or - 15% for benzidine and 76 + or - 9% for DCB. Storage of several wastewater samples for (two or seven days) at 41°C and pH 2 resulted in degradation of the compounds in several cases, probably due to oxidation or irreversible adsorption to particulate matter. Therefore, in order to obtain accurate values for benzidine and DCB, it is believed to be necessary to assay the sample as soon after collection as possible. For samples containing chlorine, a reducing agent such as sodium thiosulfate must be added, since chlorine was found to rapidly degrade benzidine and DCB. (Author's abstract) W83-00292

#### INCREASING ARCAT TEST SENSITIVITY FOR EXAMINATION OF POTABLE WATERS,

Atlantic Research Corp., Alexandria, VA.  
For primary bibliographic entry see Field 5F. W83-00293

#### PRECONCENTRATION OF ENVIRONMENTAL TIN AND ITS DETERMINATION USING CATECHOL VIOLET,

Reading Univ. (England). Dept. of Chemistry.  
M. Omar, and H. J. M. Bowen.  
Analyst, Vol 107, No 1275, p 654-658, June, 1982. 1 Fig., 2 Tab., 30 Ref.

Descriptors: \*Tin, \*Pollutant identification, Metals, Heavy metals, \*Water analysis, Sediments, Lake sediments, \*Spectrophotometry.

Inorganic tin was determined in natural waters by preconcentration in polyurethane foam soaked in toluene-3,4-dithiol followed by spectrophotometric measurement of its catechol violet and cetyltrimethylammonium bromide (CTAB) complex. The preconcentration step was accomplished by reducing any  $\text{Sn}^{4+}$  to  $\text{Sn}^{2+}$  with mercaptoacetic acid at pH 4, and passing the 1 liter sample through a 15 cm long, 1.5 cm diameter glass column containing 0.4 g of polyurethane foam-dithiol at the rate of 3-5 ml per min. The column

was eluted with acetone and 1 M NaOH at 2 ml per min. The first 2.5 ml of eluate was discarded.

Concentration was 100-fold. After wet ashing, dissolving with 5M sulfuric acid, addition of 5M potassium iodide solution, and extraction with toluene, the aqueous phase was treated with catechol violet and CTAB to form a complex. Absorbance was measured at 650 nm. Interfering elements were Ge, Mo, and Sb(5+). Tin was determined in reference materials, 8 geological and 4 biological. Recoveries were 96 + or - 3%, as determined by tracer studies, and concentrations were on the same order as those obtained by other researchers. Lake sediment and water samples analyzed by the method had tin levels of 5.3 + or - 0.3 micrograms per g and 1.07 + or - 0.21 ng per g, respectively. Although this method allowed separation of  $\text{Sn}^{4+}$  from  $\text{Sn}^{2+}$  in distilled water, it was not successful with natural waters. (Cassar-FRC) W83-00348

### 5B. Sources Of Pollution

#### MUNICIPAL POINT SOURCE AND AGRICULTURAL NONPOINT SOURCE CONTRIBUTION TO COASTAL EUTROPHICATION,

Tennessee Valley Authority, Knoxville, TN.  
A. M. Duda.  
Water Resources Bulletin, Vol 18, No 3, p 397-407, June, 1982. 6 Fig., 2 Tab., 42 Ref.

Descriptors: \*Coastal pollution, \*Water pollution effects, \*Eutrophication, \*Farm wastes, \*Estuaries, \*Water pollution sources, Nutrients, Animal wastes, Fishkill, Tidal rivers, Tidal effects, Nuisance algae, Municipal wastes, Coastal waters, Nitrogen, Phosphorus, Nitrates, \*North Carolina, Chowan River.

Some tidal coastal rivers of eastern North Carolina are suffering from serious water quality deterioration in the form of massive algal blooms, fish kills, red sore disease among fish, fresh water intrusion into estuaries and decline of commercial and sport fishing. A study of point and nonpoint sources of nutrient inputs was carried out on the eutrophic Chowan River. Nonpoint source loading was the major cause of nutrient flux from the river basin, accounting for 97% of the nitrogen and 94% of the phosphorus load entering the Chowan River watershed. Levels of nitrate nitrogen and total phosphorus were from 5 to 40 times greater in agricultural watersheds than in forested watersheds of the river basin. The timing of the spring input of nutrients from nonpoint sources and the high levels of nutrients recorded in agricultural watersheds implicate agricultural sources as an important factor in determining whether massive blooms of blue-green algae occur during a given year in the Chowan River. In years with high spring precipitation, massive surface blooms of algae have occurred. In years with low spring flows, the noxious blooms do not occur despite continued input of municipal and industrial point source discharges. The present data suggests that the coastal eutrophication in question is arising mainly from farming and animal operations along the Chowan River basin. Agricultural drainage improvements such as tile drains, intensive ditch systems, and channelization projects through wetlands may ease the situation. (Geiger-FRC) W83-00001

#### AEROBIC DEGRADATION OF DIURON BY AQUATIC MICROORGANISMS,

Clemson Univ., SC. Dept. of Microbiology.  
P. A. Ellis, and N. D. Camper.  
Journal of Environmental Science and Health, Part B, Vol 17, No 3, p 277-289, 1982. 4 Tab., 13 Ref.

Descriptors: \*Diuron, \*Biodegradation, \*Fate of pollutants, \*Microorganisms, Herbicides, Pesticides, Pesticide kinetics, Urea pesticides, Degradation, Degradation products, Bacteria, \*Aerobic conditions, Fungi, Sediments, Adsorption, Ponds, Agricultural chemicals.

The aerobic degradation of diuron by microorganisms isolated from pond water and sediments was examined in laboratory tests. Cultures capable of

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Sources Of Pollution—Group 5B

degrading the herbicide were isolated by enrichment techniques. Cultures capable of degrading diuron included several mixed fungal/bacterial cultures and some mixed bacteria cultures. These mixed cultures degraded from 67 to 99% of the added herbicide, forming from six to seven degradation products which were separated by thin-layer chromatography methods. A major degradation product found in most cultures was 3,4-dichloroaniline. Other commonly found products were 3-(3,4-dichlorophenyl)-2-methylurea and 3-(3,4-dichlorophenyl)urea. N-Demethylation of the herbicide appeared to be by far the major pathway of degradation by the cultures obtained in both enrichment series (water and sediment collected in April and August) and in the mixed cultures. (Geiger-FRC) W83-00002

**THE INCIDENCE OF VIBRIO CHOLERAE IN WATER, ANIMALS AND BIRDS IN KENT, ENGLAND.**  
Preston Hall Hospital, Maidstone (England). Public Health Lab.  
J. V. Lee, D. J. Bashford, T. J. Donovan, A. L. Furniss, and P. A. West.  
Journal of Applied Bacteriology, Vol 52, No 2, p 281-291, 1982. 1 Fig, 5 Tab, 31 Ref.

**Descriptors:** \*Vibrio, \*Fate of pollutants, \*Gulls, \*Brackish water, Bacteria, Cholera, Path of pollutants, Salinity, Waterfowl, Birds, Water birds, Human diseases, Sodium, Sheep, Natural waters, Public health, \*England.

A three year study was carried out in Kent, England to establish whether *Vibrio cholerae* occurred in the natural waters there and to see if its incidence could be related to any other factors such as the input of sewage effluent into the environment. Several surveys showed that the bacterium occurred sporadically in all types of water during the summer but only in small numbers in waters of low salinity (< 5 millimoles sodium ion/liter). The greatest numbers of colony forming units were detected in static brackish waters containing 25-200 millimoles of sodium ion/liter. No correlation was found between *E. coli* and *V. cholerae* counts. It was concluded that *V. cholerae* was not introduced by sewage contamination of water supplies. A large number of serovars, including O1, the causative agent of pandemic cholera, were identified. *V. cholerae* was detected in 6% of the cloacal swabs taken from gulls caught at times when the bacterium could not be isolated from water. It was concluded that the presence of these organisms in the environment in Kent does not present any significant threat to health. Aquatic birds were seen as possible vectors of *V. cholerae*. It was also concluded that *V. cholerae* occurred naturally in static brackish water. (Geiger-FRC) W83-00012

**CHARACTERIZATION OF PLUTONIUM IN GROUND WATER NEAR THE IDAHO CHEMICAL PROCESSING PLANT,**  
Geological Survey, Lakewood, CO.  
J. M. Cleveland, and T. F. Rees.  
Environmental Science and Technology, Vol 16, No 7, p 437-439, July, 1982. 1 Fig, 3 Tab, 6 Ref.

**Descriptors:** \*Plutonium, \*Radioactive waste disposal, \*Groundwater pollution, Path of pollutants, Fate of pollutants, Waste disposal, Leachates, Disposal wells, Chelation, Adsorption, Idaho, Chemical reactions.

Plutonium-238 in very low concentrations, 55-78 fCi per liter, was detected in one monitoring well about 200 meters from the disposal well at the Idaho Chemical Processing Plant, which processes highly enriched uranium fuels. The waste solution discharged into the disposal well contained an average Pu238 concentration of 1037 fCi per liter. At wells located further from the disposal site Pu238 concentrations were less than the detection limit of 10 fCi per liter. Therefore, about 80% of the Pu238 had been removed by precipitation or sorption during its travel through the soil. Pu238 was present in the uncomplexed, perhaps hydroxy, tetravalent state because strong organic complex-

ing agents were not present in this location. Pu238 was present in such low concentrations in the wells primarily due to the absence of these same organic complexing agents which would have stabilized Pu238 against precipitation or sorption. This study serves to emphasize the need for isolating plutonium-containing wastes from dissolved organic species in ground water. (Cassar-FRC) W83-00019

#### INDUCTION OF HIGH PHOSPHATASE ACTIVITY BY ALUMINUM IN ACID LAKES, Uppsala Univ. (Sweden). Inst. of Limnology. M. Jansson.

Archiv fur Hydrobiologie, Vol 93, No 1, p 32-44, November, 1981. 3 Fig, 4 Tab, 11 Ref.

**Descriptors:** \*Enzymes, \*Aluminum, \*Acidic water, Lakes, Lake Gardsjön, \*Sweden, \*Phosphatases, Iron, Metals, Phytoplankton, Algae, Inhibition, Hydrolysis, Water pollution effects, Fate of pollutants.

Acid phosphomonoesterase activity in acid (pH 4.5) Lake Gardsjön, Sweden, is 10 times higher than in other Swedish lakes. This study investigated the mechanisms behind the phenomenon and concluded that Al(3+) at the high concentrations present in the lake (0.3 mg per liter) reacted with available phosphates, thus blocking the natural substrates and preventing enzymatic recycling of organic P. Organisms in the lake increased production of phosphatases to compete with the Al. Experiments revealed that: (1) the Al(3+) and Fe(3+) combined with the phosphate group on the substrate, making it unavailable to enzymatic attack; solutions of the metals at concentrations as low as 0.00005 M were inhibitory; (2) both enzymes and metals competed for the esterified phosphate, (3) the high phosphatase concentration in the lake was sufficient to outcompete the high levels of Al in the water; Fe concentration was too low to have a significant effect; and (4) artificially increasing the metal-to-phosphatase ratio produced increases in phosphatase production. (Cassar-FRC) W83-00029

#### WATER QUALITY OF STREAMS IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK,

Great Smoky Mountains National Park, Gatlinburg, TN. Uplands Field Research Lab.  
D. G. Silsbee, and G. L. Larson.  
Hydrobiologia, Vol 89, No 2, p 97-115, April, 1982. 10 Fig, 6 Tab, 34 Ref.

**Descriptors:** \*Natural streams, \*Water quality management, \*Monitoring, \*Watershed management, \*Water pollution sources, Physical properties, \*Chemical properties, Biological properties, Streams, Water quality control, Forest watersheds, Hydrogen ion concentration, Turbidity, Minerals, Nitrates, Seasonal variation, Alkalinity, Elevation, \*Smoky Mountains, Mountains, Sodium, Potassium, Calcium, Magnesium, Silicon, Bacteria, Logging, Storms.

A one-year water monitoring program was conducted on streams of the Great Smoky Mountains National Park to establish which factors were most important in controlling streamwater quality and to provide baseline information for long term monitoring of park water quality and future aquatic research. Sixteen physical, chemical, and bacteriological water quality parameters were evaluated at the base of most of the 28 major drainages in the park. In the lower elevations, values for bacterial density, pH, alkalinity, turbidity, and concentrations of Na, K, an Si were higher than those recorded at higher elevations. Nitrate levels increased with elevation. In watersheds where logging was practiced, nitrate concentrations were significantly lower than those of unlogged watersheds at similar elevations. Alkalinity, pH, conductivity, hardness, and levels of Na, K, Ca, Mg and Si were affected by bedrock geology. Most water quality parameters exhibited higher concentrations or values in the summer than in the winter. Discharge and nitrate concentrations were both highest in winter and spring and lowest in fall. Storm

events frequently caused dramatic changes in streamwater quality. (Geiger-FRC) W83-00032

#### PHYSICOCHEMICAL LIMNOLOGY OF THE TONGUE RIVER RESERVOIR, MONTANA, Alaska Univ., Fairbanks. Inst. of Marine Science. For primary bibliographic entry see Field 2H. W83-00033

#### LIMNOLOGICAL INVESTIGATIONS OF A MOUNTAIN SPRING POND IN THE SWISS NATIONAL PARK, Zurich Univ. (Switzerland). Hydrobiological-Limnological Station. For primary bibliographic entry see Field 2H. W83-00034

**SOME NOTES ON THE ECOLOGY OF AQUATIC OLIGOCHAETES IN THE DELTA REGION OF THE NETHERLANDS,**  
Provincial Water Authority, Zwolle (Netherlands). Dept. of Watershed Management. For primary bibliographic entry see Field 2L. W83-00035

**INVESTIGATIONS ON THE LAKES OF PERU AND THEIR PHYTOPLANKTON. 6 ADDITIONAL CHEMICAL ANALYSES,**  
Kernforschungsanlage, Juelich (Germany, F.R.). Inst. fuer Biotechnologie III. For primary bibliographic entry see Field 2H. W83-00037

**ADSORPTION OF PAH TO AQUATIC HUMUS,**  
Norwegian Inst. for Water Research, Oslo (Norway). E. T. Gjessing, and L. Berglund.  
Archiv fur Hydrobiologie, Vol 92, No 1, p 24-30, August, 1981. 1 Fig, 2 Tab, 14 Ref.

**Descriptors:** \*Aromatic compounds, \*Humic acids, \*Adsorption, \*Polyaromatic hydrocarbons, Benzo(a)pyrene, Hydrocarbons, Organic matter, Color, Fate of pollutants, Pollutant identification, Water analysis, Organic compounds.

Polyaromatic hydrocarbons (PAH) added to natural waters containing humus were only 2-7% extractable by the XAD-2 ion exchange recovery technique, both common methods of determining PAH. The water samples varied in color from 22 to 105 mg Pt per liter, and in dissolved organic concentrations from 5 to 14 mg C per liter. None were impacted by human activity. These results suggest that PAH levels in humic waters are underestimated and that mobility of PAH is increased in the presence of humus. (Cassar-FRC) W83-00038

#### METAL BINDING CAPACITY IN RELATION TO HYDROLOGY AND ALgal PERIODICITY IN TJEUKEMEER, THE NETHERLANDS,

Limnological Inst., Oosterzee (Netherlands). Tjeukemeer Lab.

H. De Haan, T. De Boer, and H. L. Hoogveld.  
Archiv fur Hydrobiologie, Vol 92, No 1, p 22-23, August, 1981. 5 Fig, 1 Tab, 34 Ref.

**Descriptors:** \*Copper, \*Chelation, \*Algae, Lakes, Humic acids, Fulvic acids, Color, Organic matter, Tjeukemeer Lake, \*The Netherlands, Polders, Chlorophyll A, Phytoplankton, Productivity, Eutrophication, Fate of pollutants, Decomposing organic matter, Iron nutrients, Algal growth.

The copper binding capacity (CuBC) of Tjeukemeer water was monitored from June 1977 to December 1979. This shallow productive peaty lake in the Netherlands receives humus-rich water in winter and humus-poor water in summer. CuBC ranged from 250 micrograms per liter in fall to 800 micrograms per liter in summer, average 490 micrograms per liter, as measured by the dibenzylidithiocarbamate method. Correlation of

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

water color and CuBC in 1979 suggested that the CuBC was controlled by the input of polder water high in fulvic acids. The polder water was richer in organic carbon than the lake, but the ratio of CuBC per unit of organic carbon was higher in lake water, a result of the higher chlorophyll a levels in the lake. Summer peak values of CuBC in 1977 and 1978 were associated with the decline of the blue-green algal populations of *Aphanizomenon* spp. and *Oscillatoria redekei*. Another peak observed in November 1977 was attributed to the decline of a green algal population, *Planktomea lauterbornii*. A high CuBC in October 1978 was seen during an algal bloom (*Aphanizomenon* spp.) during low Fe concentrations. This suggested that the *Aphanizomenon* cells excreted metal chelators under Fe limitation conditions. (Cassar-FRC) W83-00039

**NITROGEN METABOLISM IN LAKE KIZAKI, JAPAN. III. ACTIVE NITRIFICATION IN EARLY SUMMER,**  
Nagoya Univ. (Japan). Water Research Inst.  
For primary bibliographic entry see Field 2H.  
W83-00040

**PHYTOPLANKTON CONTRIBUTION TO ALKALINE PHOSPHATASE ACTIVITY,**  
Oak Ridge National Lab., TN. Environmental Sciences Div.  
For primary bibliographic entry see Field 2H.  
W83-00041

**DIFFERENTIAL PULSE POLAROGRAPHY OF SOME HERBICIDES DERIVED FROM 2,4-DICHLOROPHOXYACETIC ACID, II. DETERMINATION OF HERBICIDE RESIDUES IN IRRIGATION WATERS,**  
Kernforschungsanstalt Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie.  
For primary bibliographic entry see Field 5A.  
W83-00045

**DIEL PERIODICITY IN THE CHEMICAL COMPOSITION OF LAKE PHYTOPLANKTON,**  
University of Science and Technology, Kumasi (Ghana). Dept. of Biological Sciences.  
E. Frempong.  
Archiv fur Hydrobiologie, Vol. 92, No. 4, p 457-495, November, 1981. 7 Fig, 8 Tab, 50 Ref.

Descriptors: \*Diurnal distribution, \*Phytoplankton, \*Biomass, Seasonal variation, Statistical analysis, Carbohydrates, Chemical composition, Esthwaite Water, \*England, Stratification, Chlorophyll a, Carotenoids, Nitrogen, Carbon, Lakes, Particulate matter, Irradiation, Chemical composition, Algae, \*Eutrophic lakes.

Several indices of biomass and physiological state were determined for phytoplankton in the productive Esthwaite Water, England, for eight 24 hour periods between June 1977 and September 1978. Various ratios were used as indicators of diel periodicity. Ratios of carbohydrate to chlorophyll a, carbon, or nitrogen were more sensitive, by at least a factor of 2, to diel variations in the 0-8 m water column than other ratios, chlorophyll a:carbon, carbon:nitrogen, and carotenoids:chlorophyll a. In April the carbohydrate indices showed diel changes of + or - 21%, whereas other indices of biomass composition showed 4-7% variation. Factors which strongly affected the indices were seasonal variation, phase of stratification, dominant algal species, redistribution of biomass, and high surface irradiance. Indices involving carbohydrate are seen as useful indicators in monitoring diel periodicities in the physiological state and biomass of phytoplankton. (Cassar-FRC) W83-00056

**STORAGE OF CARBON AND TRANSPORT OF OXYGEN IN RIVER MACROPHYTES: MASS-BALANCE, AND THE MEASUREMENT OF PRIMARY PRODUCTIVITY IN RIVERS,**  
Miljostyrelsen, Silkeborg (Denmark). Freshwater Lab.  
B. Moeslund, M. G. Kelly, and N. Thyssen.

Archiv fur Hydrobiologie, Vol. 93, No. 1, p 45-51, November, 1981. 2 Fig, 1 Tab, 4 Ref.

Descriptors: \*Aquatic plants, \*Vascular tissues, \*Oxygen transfer, \*Productivity, Lag time, Bicarbonates, Carbon dioxide, Rivers, Mosses, Algae, Macrophytes, \*Primary productivity, Mass transfer, Plant tissues, Aeration, Light intensity.

For several species of vascular river macrophytes the lag time between onset of illumination and the start of inorganic carbon uptake and the lag between darkness and cessation of carbon uptake were 3-5 min. The species were *Ceratophyllum demersum*, *Elatostoma canadensis*, *Myriophyllum alterniflorum*, *Potamogeton crispus*, and *Sparagnum* sp. *Cladophora glomerata*, an alga, and *Fontinalis antipyretica*, a moss, showed similar lag times. Therefore, storage of inorganic carbon in aerenchyma was negligible and unimportant for measuring or modeling productivity. The photosynthetic quotients of laboratory plants without roots and in river plant communities were similar, suggesting that transport of gases to and from the roots is unimportant for plants rooted in well-aerated sediments. (Cassar-FRC) W83-00051

**SOME ASPECTS OF THE COLONIZATION BY WATER MITES (ACARI, ACTINIDIDA) OF AN ARTIFICIAL SUBSTRATE IN A DISTURBED ENVIRONMENT,**  
Louvain Univ. (Belgium). Lab. of General and Experimental Ecology.  
For primary bibliographic entry see Field 5C.  
W83-00054

**SPECIES COMPOSITION AND DISTRIBUTION OF ZOOPLANKTON IN A TROPICAL LAKE, LAKE NAIVASHA, KENYA,**  
Nairobi Univ. (Kenya). Dept. of Zoology.  
K. M. Mavuti, and M. R. Litterick.  
Archiv fur Hydrobiologie, Vol. 93, No. 1, p 52-58, November, 1981. 2 Fig, 2 Tab, 7 Ref.

Descriptors: \*Zooplankton, \*Seasonal variation, \*Species composition, Lakes, Lake Naivasha, \*Kenya, Species diversity, Invertebrates, Copepods, Cladocerans, Rotifers, Tropical regions, Fish food organisms, Predation, Biomass, Benthos, Food chains.

The zooplankton community of Lake Naivasha, Kenya, was documented for the first time from July 1978 to July 1980. Samples were collected at a depth of 7 meters at 3 stations in the main lake area. The dominant limnetic zooplankton were the copepod *Thermocyclops oblongatus*, the cladoceran *Diaphanosoma excisum* and *Simocephalus vetulus*, and the rotifers, *Brachionus caudatus* and *B. calyciflorus*. A total of 26 species were recorded, including *Daphnia laevis*, for the first time in Kenya. *D. laevis* and *Simocephalus vetulus*, which produced occasional population eruptions, were responsible for about 10% of the cladoceran biomass. Total zooplankton increased from 60 individuals per liter in December to a stable population of 200-300 per liter in spring. After July the population declined until the November-December low. *T. oblongatus* represented 58% (102 + or - 53 individuals per liter) of the total numerical count of zooplankton. Rotifers contributed < 5% to the total zooplankton biomass. Biomass showed a complex pattern with 2 annual peaks, coinciding with the 2 rainy seasons in fall and spring. Annual mean standing crop was 220 mg dw per cu m, range 70-370 mg dw per cu m. Lack of predation causes *S. vetulus*, usually a littoral cladoceran, to be found in both littoral and limnetic locations. Nearly all zooplankton production enters the decomposer food chain. (Cassar-FRC) W83-00056

**AN APPRAISAL OF SURFACE-WATER QUALITY IN THE ALAMEDA CREEK BASIN, CALIFORNIA, OCTOBER 1974-JUNE 1979,**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
L. E. Lopp.

Available from the National Technical Information Service, Springfield, VA 22161 as PB82-201575.

Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 81-46, December, 1981. 33 p, 12 Fig, 4 Tab, 11 Ref.

Descriptors: \*Surface water, \*Water quality, \*Wastewater, \*Surface-groundwater relations, Recharge, Wastewater disposal, Water analysis, Water properties, \*California, Alameda Creek basin.

Areal and seasonal variations in the quality of surface water in the Alameda Creek basin, California, from 1974 to 1979 were analyzed to determine the effects of wastewater discharges and imported water releases. Statistically significant differences were found among mean values of constituents in streamflow below the treated wastewater discharge points, imported water released from the South Bay Aqueduct, and the combined outflow at Alameda Creek near Niles. During periods before and after the drought of 1976-1977, concentrations of dissolved solids, dissolved chloride, and total nitrate varied inversely with water discharge. From 1974 to 1976, decreases in nutrient values coincided with increased in imported water releases. Values of physical properties and chemical constituents decreased during the spring and summer of 1976. During the second winter of the drought, imported water was decreased, and concentrations of dissolved solids, chloride, and total nitrate increased dramatically in the water at Alameda Creek near Niles. At the upstream tributary, Arroyo de la Laguna, increased chemical property and constituent values during 1976 and 1977 were attributed to decreased natural flow, hence the greater contribution of wastewater treatment plant effluent. Concentrations of several constituents exceeded limits set by the State water-quality objectives for the basin. With the return to normal flow levels in 1978-79, some concentrations returned to predrought levels. (USGS) W83-00064

**INSTALLATION AND SAMPLING OF OBSERVATION WELLS AND ANALYSES OF WATER FROM THE SHALLOW AQUIFER AT SELECTED WASTE-DISPOSAL SITES IN THE MEMPHIS AREA, TENNESSEE,**  
Geological Survey, Memphis, TN. Water Resources Div.  
W. S. Parks, D. D. Graham, and J. F. Lowery.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$4.50 in paper copy, \$3.50 in microfiche. Open-File Report 82-266, 1982. 32 p, 7 Fig, 3 Tab, 6 Ref.

Descriptors: \*Water quality, \*Groundwater, \*Waste disposal, \*Observation wells, Water sampling, Water analysis, Aquifers, Alluvial deposits, Confining beds, Water level, Recharge, Leakage, Landfills, Contamination, Water pollution, Data collections, \*Tennessee, Memphis, Memphis sand.

Observation wells were installed and sampled at six abandoned waste-disposal sites in the Memphis area that have been identified as having received unknown quantities and types of industrial waste. Ten wells were installed adjacent to and downgradient from these sites in the shallow water-table aquifer. Water samples were collected from these 10 wells and from two other wells in the shallow water-table aquifer. Most wells were sampled twice -- initially in the early summer when water levels were high and again in the fall when water levels were low. Other wells were sampled only once in either the summer or fall. The water was analyzed for common constituents, selected trace constituents, and selected organic compounds. (USGS) W83-00066

**EFFECTS OF EFFLUENT SPRAY IRRIGATION ON GROUND WATER AT A TEST SITE NEAR TARPO SPRINGS, FLORIDA,**  
Geological Survey, Tallahassee, FL. Water Resources Div.

D. P. Brown.  
Open-File Report 81-1197, 1982. 36 p, 9 Fig, 13 Tab, 16 Ref.

Descriptors: \*Groundwater, \*Water quality, \*Path of pollutants, \*Effluents, Spray irrigation, Obser-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Sources Of Pollution—Group 5B

vation wells, Monitoring, Agricultural chemicals, Fertilizers, Nitrogen compounds, Bacteria, Aquifers, Chemical analysis, \*Florida, Tarpon Springs.

Secondary-treated effluent was applied to a 7.2-acre test site near Tarpon Springs, Fla., for about 1 year at an average rate of 0.06 million gallons per day and 3 years at 0.11 million gallons per day. Chemical fertilizer was applied periodically to the test site and adjacent areas. Periodic mounding of the water table occurred due to effluent irrigation, inducing radial flow from the test site. Physical, geochemical, biochemical processes effectively reduced total nitrogen concentration 90% and total phosphorus concentration more than 95% in the ground water of the surficial aquifer about 300 feet downgradient from the test site from that of the applied effluent. Downgradient, total nitrogen averaged 2.4 milligrams per liter and total phosphorus averaged 0.17 milligrams per liter. Substantial increases in total phosphorus were observed when the pH of the ground water increased. Total coliform bacteria in the ground water of the surficial aquifer were generally less than 100 colonies per 100 milliliters. Fecal coliform bacteria were generally less than 25 colonies per 100 milliliters at the test site and were not detected downgradient or near the test site. Fecal streptococcal bacteria were generally less than 100 colonies per 100 milliliters at the test site, but were detected on three occasions near the test site. (USGS)

W83-00068

#### GEOHYDROLOGIC DESCRIPTIONS OF SELECTED SOLID-WASTE DISPOSAL SITES, Geological Survey, San Juan, PR. Water Resources Div.

A. Torres-Gonzalez, and F. Gomez-Gomez. Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$19.75 in paper copy, \$3.50 in microfiche. Open-File Report 81-490, 1982. 146 p, 51 Fig, 28 Tab, 28 Ref, Append.

Descriptors: \*Water quality, \*Streams, \*Water pollution, \*Solid waste disposal, Sites, Leachates, Permeability, Path of pollutants, Headwaters, Water table, \*Puerto Rico.

Fifty solid-waste disposal sites in Puerto Rico were examined in 1977 and ranked according to their potential for degradation of the water resources. Twenty-five of the sites show significant leachate pollution potential. The cover material at 21 sites is relatively permeable and offers insignificant attenuation to leachates. Thirty-six sites are adjacent to streams and nine of these are located in headwater areas. Rainfall is abundant and at 40 of the sites exceeds 1,500 millimeters per year. General descriptions of the 50 disposal sites are given with their geohydrologic setting. Baseline data consisting of specific conductance, pH, temperature, dissolved oxygen, and common ions were obtained at many of the sites. Such information provides a technical basis for assessing future effects of those solid-waste disposal sites on the quality of water resources. (USGS)

W83-00072

#### WATER-QUALITY ASSESSMENT OF STEINER BRANCH BASIN, LAFAYETTE COUNTY, WISCONSIN, Geological Survey, Madison, WI. Water Resources Div.

For primary bibliographic entry see Field 4A.

W83-00123

#### A STUDY OF TRENDS IN TOTAL PHOSPHORUS MEASUREMENTS AT NASQAN STATIONS, Geological Survey, Reston, VA. Water Resources Div.

R. A. Smith, R. M. Hirsch, and J. R. Slack. Available from Supt. of Documents, GPO, Washington, DC 20402, Price: \$4.50. Water-Supply Paper 2190, 1982. 34 p, 11 Fig, 4 Tab, 17 Ref, 2 Append.

Descriptors: \*Water quality, \*Phosphorus, \*Water pollution control, \*Statistical methods, Eutrophication, Nutrients, Nonpoint source pollution, Data collections, \*Nasqan, Seasonal Kendall test.

A new test for trend, called the Seasonal Kendall test, is defined. The test is shown to have properties that make it a good test for detecting trends in water-quality data. As a demonstration, the test is applied to 5- to 8-year time series of total phosphorus data collected monthly at more than 300 stations in the National Stream Quality Accounting Network (NASQAN). The test is applied to time series of concentration values, instantaneous transport (load) values, and flow adjusted concentrations. Flow adjusted concentrations are defined as the residuals from a regression of concentration on a function of stream discharge. For each station, the regression function is selected from among 11 possible relationships on the basis of  $R^2$  value. Under 2 different significance criteria ( $\alpha = 0.10$  and  $\alpha = 0.01$ , two-tailed), significant trends are observed at far more NASQAN stations than would be expected by chance alone. Of 303 stations tested for trends in phosphorus concentration, 38 showed significant ( $\alpha = 0.10$ ) uprends and 62 showed significant downrends. Of 289 stations tested for trends in transport rate, 62 showed significant downtrends and only 23 showed significant uprends. Trend tests on flow-adjusted concentrations were quite different from trend tests on unadjusted concentration data; 45 stations showed significant downtrends and 40 showed significant uprends. (USGS)

W83-00126

#### HYDROGEOLOGY AND RESULTS OF INJECTION TESTS AT WASTE-INJECTION TEST SITES IN PINELLAS COUNTY, FLORIDA, Geological Survey, Tallahassee, FL. Water Resources Div.

J. J. Hickey. Available from Supt. of Documents, GPO, Washington, DC 20402, Price: \$6.00. Water-Supply Paper 2183, 1982. 42 p, 32 Fig, 8 Tab, 34 Ref.

Descriptors: \*Injection wells, \*Groundwater, \*Water quality, \*Waste disposal wells, Path of pollutants, Carbonate rocks, Aquifer characteristics, Groundwater movement, Chemical properties, Water analysis, Evaluation, \*Florida, Pinellas County, Floridian aquifer.

In cooperation with Pinellas County, Fla., and the city of St. Petersburg, the U.S. Geological Survey undertook an evaluation of subsurface injection of wastewater. The injection sites are underlain by carbonate rocks. Lower Eocene rocks were penetrated and had relatively low water yields. The most productive rocks penetrated were of middle Eocene age within the Floridian aquifer. The aquifer was subdivided into four permeable zones and three semiconfining beds. The test injection zone has a transmissivity estimated to be about 1,000,000 feet squared per day. Parts of the zone are intensely shattered. Saltwater flow is probably occurring within the zone. Two semiconfining beds are above and have vertical hydraulic conductivities estimated to range from about 0.1 to 1 foot per day. Limited fresh ground water is in the Floridian aquifer at the test sites. Chloride concentration of native water in the injection zone ranges from 19,000 to 20,000 milligrams per liter. Injection tests from 3 to 91.1 days were run at three sites. Pressure buildup close to and at some distance from the test wells was typically less than 1 pound per square inch. The injected water was well mixed with formation water as a consequence of the fractured nature of the injection zone. (USGS)

W83-00129

#### SEASONAL CHANGES OF DISSOLVED SODIUM IN THE CONNECTICUT RIVER NEAR NORTHFIELD, MASSACHUSETTS, Massachusetts Univ., Amherst. School of Health Sciences.

G. A. Kane, and E. J. Calabrese. Journal of the New England Water Works Association, Vol 96, No 2, p 127-134, 1982. 4 Fig, 11 Ref.

Descriptors: \*Sodium, \*Salt, \*Drinking water, Pollutant identification, \*Connecticut River, Quabbin Reservoir, Northfield, \*Massachusetts, Rivers, Diversion, Deicers, Reservoirs, Seasonal variation, Water analysis, Water pollution sources.

Sodium levels were determined from July 1979 to May 1980 at 4 stations in the Connecticut River near Northfield, Massachusetts. Public concern about the water quality in the river developed when a diversion to the Quabbin Reservoir, Boston's drinking water supply, was proposed. Application of salt in winter to highways paralleling the river posed a threat of salt contamination of the river. Annual average dissolved sodium at the 4 stations was 4.9 mg per liter, mean 5.6 mg per liter. The major peak, 6.9 mg per liter, was in July, with a minor peak, 6.7 mg per liter, in February. There were no significant differences along the 47.5 mile distance between stations. Comparison with Na concentration data from 1961-62, 1964-65, and 1966-67 showed that Na levels have not noticeably changed. Sodium levels found in this potential drinking water source are not considered a health hazard. (Cassar-FRC)

W83-00139

**MULTIPLE PURGE TECHNIQUES FOR DETERMINING ORGANIC POLLUTANTS IN GROUNDWATER,** Connecticut Agricultural Experiment Station, New Haven. For primary bibliographic entry see Field 5A. W83-00158

#### ASSOCIATION STUDIES OF POLYBROMINATED BIPHENYLS IN AQUATIC SYSTEMS, Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.

M. S. Simmons, and K. T. Kotz. Bulletin of Environmental Contamination and Toxicology, Vol 29, No 1, p 58-63, 1982. 4 Tab, 10 Ref.

Descriptors: \*Polybrominated biphenyls, \*Adsorption, \*Sediments, Organic carbon, Natural waters, Lakes, Rivers, Water, Water pollution effects, Water sampling, Sampling, Kinetics, Humic acid, \*Lake Michigan, \*Huron River.

Factors that determine the mode of action of polybrominated biphenyls (PBB), their movement through the water column and deposition and adsorption onto sediments were studied. The influence of the organic content of the sediment and the influence of the overlying water on the adsorption process were investigated. Sediments and overlying waters were sampled in Lake Michigan and the Huron River using ponar grab and Kemmerer samplers. Kinetic studies were performed in a closed reactor system for both distilled and natural water/sediment systems. Adsorption isotherm experiments were also performed. During kinetic studies, relationships of the TOC of water to the adsorptive capacity of the BR-2 sediment was investigated by addition of varying amounts of humic acid to water. Results indicated that the TOC of water will decrease the adsorption of PBB onto the sediment. (Small-FRC)

W83-00160

**CHARACTERIZATION OF ORGANIC CONTAMINANTS IN ENVIRONMENTAL SAMPLES ASSOCIATED WITH MOUNT ST. HELENE 1980 VOLCANIC ERUPTION,** Geological Survey, Denver, CO; and Bureau of Reclamation, Denver, CO. Denver Federal Center.

For primary bibliographic entry see Field 5A.

W83-00161

**WATER CHARACTERISTICS,** Construction Engineering Research Lab. (Army), Champaign, IL.

E. D. Smith. Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 541-554, June, 1982. 174 Ref.

Descriptors: \*Literature reviews, \*Water quality, \*Water pollution effects, \*Fate of pollutants, \*Re-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

views, Acid rain, Snowmelt, Water pollution sources, Pollutant identification, Color, Odors, Taste, Optical properties, Water temperature, Dissolved oxygen, Suspended solids, Suspended sediment, Turbidity, Adsorption, Salinity, Dissolved solids, Acidity, Alkalinity, Hardness, Oxidation-reduction potential, Carbon dioxide, Public health.

Acid rain, color, odor, taste, optical properties, temperature, dissolved oxygen, suspended solids, salinity and dissolved solids, and radioactivity were among the water quality parameters reviewed with reference to 1981 research. A large amount of research was published on acid precipitation and its effects. Methods for simple determination of color in water were developed, and methods of removing color from water were presented. Odor sources in reservoirs were identified as microorganisms and algal blooms. Optical properties of pure water and of water bodies were handled in several papers. Topics concerning dissolved oxygen included stream reaeration models, causes of fishkills, and oxygen depletion. Many analytical techniques for measuring sediments were developed. Adsorption and release of pollutants on sediments and sediment transport were discussed. Effects and methods for determining salinity and dissolved solids were actively studied. The interrelated parameters of acidity, alkalinity, hardness, redox potential, and pH, were the subjects of papers on analytical determination, relationship to health effects, effects on aquatic organisms, carbon dioxide emissions to the atmosphere, and interaction with phytoplankton. Papers on radio activity were numerous. (Cassar-FRC)

W83-00169

#### TRACING WELL WATER POLLUTION IN A LIMESTONE AQUIFER,

Engineering Technology, Inc., New Orleans, LA. C. P. Thomas, and S. Beckford.

Journal of the American Water Works Association, Vol 74, No 4, p 182-187, April, 1982. 2 Fig, 2 Tab, 6 Ref.

Descriptors: \*Groundwater pollution, \*Groundwater movement, Aquifers, Dye releases, Tracers, Wells, Wastewater, Runoff, Surface runoff, Agricultural runoff, Industrial wastewater, Fate of pollutants, Jamaica.

Water from wells is one of the safest and least expensive ways of meeting drinking water needs in Jamaica. A major aquifer located in the Queen of Spain Valley is the principal source of water for domestic, commercial, and industrial uses in northwestern Jamaica. Periodic occurrences of high turbidity and coliform levels in the first well tapping this aquifer prompted an investigation of possible sources of the pollution and of the movement of pollution in the wellfield. A total of 65 major sinkholes, which are the most important drainage feature of this high rainfall area, were found within a 1,500 meter radius of the five domestic water supply wells. Dye-tracing studies were conducted to determine the underground flow directions and travel times of the sugar factory wastewater discharge and of surface runoff through a sinkhole that drains a large sugar cane cultivation area. Both of the dye-tracer studies provided information about the movement of pollution which could threaten the planned development of wells. The surface runoff test showed that local runoff in the area of the wellfield is likely to feed directly into the aquifer and that the conditions for this occurrence exist. There was also a definite connection between the waste stream from the sugar factory and a nearby surface stream, Tom Spring. This wastewater stream appears to flow along a well-defined subsurface course which is not connected to the well, so the water quality at the wells is not affected. These tests indicate that water quality problems in the wells are caused by surface runoff during periods of heavy rainfall which transports high sediment loads into the aquifer through sinkholes. This type of siting investigation should precede location of new wells in this aquifer in order to minimize or eliminate pollution problems. (Cassar-FRC)

W83-00173

#### TRANSPORT OF ORGANIC CARBON TO THE OCEANS BY RIVERS OF NORTH AMERICA: A SYNTHESIS OF EXISTING DATA,

Oak Ridge National Lab., TN. Environmental Sciences Div.

P. J. Mulholland, and J. A. Watts. Tellus, Vol 34, No 2, p 176-186, April, 1982. 3 Fig, 3 Tab, 31 Ref.

Descriptors: \*Organic carbon, \*Rivers, \*Carbon cycle, Runoff, \*North America, Sediment transport, \*Path of pollutants, Streamflow.

Riverflow and organic carbon concentration data from 87 North American rivers draining about 60% of Canada and the United States were compiled and analyzed in an effort to estimate the transport of organic carbon in rivers of North America to the oceans. Data used in the study were collected by the U.S. Geological Survey and by the Water Resources Branch of the Canadian Inland Waters Directorate. While annual specific export of total organic carbon ranged from about 0.01 to 8.4 grams of carbon per square meter per year, the mean annual total organic carbon concentrations showed considerably less variation, ranging from 1.6 to 21.2 grams of carbon per cubic meter. Regional variation in annual specific export of total organic carbon was attributed primarily to differences in annual runoff. Computations of mean regional total organic carbon exports from the rivers surveyed were used to calculate the total export from the North American continent by rivers. Total organic carbon exports were estimated to be 37 times 10 to the 12th power grams of carbon in 1977 and 34 times 10 to the 12th power grams of carbon in 1978. Most of this loss was from the eastern and northwestern portions of the continent, where annual runoff was greatest. Riverflows during 1977 were compared with long-term annual averages for rivers in each region in order to estimate the total organic carbon export associated with long-term average riverflow. These computation indicated that the total organic carbon flux to the oceans associated with the long-term average annual flow in North American rivers is about 40 times 10 to the 12th power grams of carbon per year. This slightly higher figure is due to the lower than average runoff experienced in some regions in 1977 and 1978. (Carroll-FRC)

W83-00174

#### PHOSPHATE AND WIND IN A SHALLOW LAKE,

Center for Environmental Studies, Leiden (Netherlands).

W. T. De Groot. Archiv für Hydrobiologie, Vol 91, No 4, p 475-489, July, 1981. 5 Fig, 3 Tab, 7 Ref.

Descriptors: \*Phosphates, \*Eutrophic lakes, \*Turbulent flow, \*Wind velocity, \*Lake Westeinder, \*Water quality control, Lake restoration, Statistical analysis, \*The Netherlands, Mathematical models, Lakes, Phosphorus, Nutrients, Mathematical studies, Phosphorus removal, Cycling nutrients, Lake sediments, Model studies, Wind.

A statistical analysis is described in which the monthly net phosphate exchange between sediment and supernatant water is the dependent variable. The analysis is based upon 28 monthly phosphate balances of the shallow eutrophic Dutch lake, Lake Westeinder. It emphasizes dataset building and the underlying causal hypothesis. The internal phosphate loadings of the lake are significantly correlated with the gross external loading and differences between two-day averages of wind velocities (rising wind induces higher phosphate concentrations) and differences between two-month averages of wind velocities (rising wind induces lower phosphate concentrations). These findings may aid in the distinction of longer and shorter term phosphate level changes and help to interpret the long term effects of wind and turbulence on the phosphate cycle when designing phosphate control measures. (Geiger-FRC)

W83-00184

#### THE CHEMISTRY AND PHYTOPLANKTON OF THE ORINOCO AND CARONI RIVERS, VENEZUELA,

Colorado Univ., Boulder. Dept. of Environmental, Population and Organismic.

W. M. Lewis, Jr., and F. Weibezahn.

Archiv für Hydrobiologie, Vol 91, No 4, p 521-528, July, 1981. 2 Fig, 4 Tab, 17 Ref.

Descriptors: \*Tropical regions, Rivers, \*Chemical properties, \*Phytoplankton, Ions, Cations, Anions, Phosphorus, Nitrogen, Nitrates, Carbon, Carbonates, Chlorides, Acidity, Sodium, Calcium, Potassium, Magnesium, \*Venezuela, \*Orinoco River, \*Caroni River.

The chemistry of the major tropical rivers of the world is of interest as an indicator of the chemical mass balance of tropical regions. Chemical and microscopic studies were conducted on water samples of the Orinoco and Caroni Rivers with special focus on nitrogen, phosphorus, and carbon and phytoplankton communities. The Orinoco at Ciudad Bolívar was slightly acidic, of low ionic content and contained a relative abundance of calcium, sodium, potassium and magnesium cations and bicarbonate, sulfate and chloride anions. The Caroni at Puerto Ordaz was more acidic and had a much lower ionic content, with greater relative amounts of sodium and chloride ions. In both rivers, phosphorus in all forms was present in very small amounts. While particulates were very poor in nitrogen, both rivers displayed a high nitrate content. The particulates, which were very abundant in the Orinoco, were mostly clastic materials. The Caroni particulates contained a lower proportion of clastic materials. Living organisms in both rivers were extremely rare. (Geiger-FRC)

W83-00187

#### STRUCTURAL CHARACTERIZATION OF AQUATIC HUMIC MATERIAL,

North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.

For primary bibliographic entry see Field 5C.

W83-00190

#### MINERALIZATION OF LINEAR ALCOHOL EPOXYLATES AND LINEAR ALCOHOL EPOXY SULFATES AT TRACE CONCENTRATIONS IN ESTUARINE WATER,

Procter and Gamble Co., Cincinnati, OH. Environmental Safety Dept.

R. D. Vashon, and B. S. Schwab. Environmental Science and Technology, Vol 16, No 7, p 433-436, July, 1982. 5 Fig, 1 Tab, 18 Ref.

Descriptors: \*Surfactants, \*Mineralization, \*Kinetics, Fate of pollutants, \*Detergents, Estuarine environment, Saline water, Decomposition, Degradation, Biodegradation, Trace levels, \*Florida, \*Esbay Bay.

Mineralization (ultimate biodegradation) of trace concentrations of linear alcohol epoxylates (LAE), nonionic surfactants, and linear alcohol ethoxy sulfates (LAES), anionic surfactants, was rapid and extensive in estuarine water. The water samples were obtained from Escambia Bay, Florida, and had salinity of 28 o/oo. The studies used 4 pure chain length materials (C16 with 3 ethoxylates, C12 with 9 ethoxylates, C16 with 9 ethoxylates and sulfate, C16 with 3 ethoxylates and sulfate) labeled either at the alpha-alkyl carbon or uniformly in the ethoxylate chain. Kinetics of mineralization of the alpha-carbon were first-order over the concentration range 850 ng per liter of 140 micrograms per liter with a half-life of 2.1 days for the alpha-alkyl carbon. Kinetics of mineralization of the ethoxylate C were also first-order at a concentration of 1 microgram per liter or less of LAE or LAES, with a half-life of 6.3 days. At high concentrations the mineralization kinetics were linear or sigmoidal. The sulfate moiety of LAES had no effect on mineralization of either alkyl or ethoxylate C. There was no threshold concentration below which the compounds did not degrade down to the lowest initial concentration tested, 7.9 times 10 to the minus 10th power M. (Cassar-FRC)

W83-00211

## Sources Of Pollution—Group 5B

## HEAVY METAL INTERACTIONS AND DYNAMICS IN SIMULATED NAUGATUCK RIVER MICROCOSSMS, Connecticut Univ. Storrs. Dept. of Civil Engineering.

A. J. Medina, and M. F. Conway.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108241. May, 1982. 70 p, 15 Fig, 8 Tab, 74 Ref, 1 Append. OWRT A-087-CONN(1), OWRT 14-34-0001-0107.

**Descriptors:** Chromium, Zinc, Iron, Ecosystems, "Lake Sediments," "Sediment-Water Interactions," "Aquatic Microcosms," Toxicity, "Naugatuck River, Chemical Equilibrium," "Heavy metals," "Connecticut, Water pollution sources, Water pollution effects."

The sediment-water interactions of heavy metals in the Naugatuck River in Summit Impoundment, a small mainstem reservoir north of Waterbury, were investigated through field studies and laboratory experiments using Three Phase Aquatic Microcosms (TPAM). Results of the study indicated high levels of NH sub 3, TOC, P, Fe, Cu, Zn and Total Cr were common in this stretch of the river. A significant reduction of highly toxic Cr (VI) was observed in Summit Impoundment and also verified in TPAM research. The high rate of Cr (VI) reduction appeared directly correlated with high concentrations of reduced aqueous species, i.e. Fe super 2+, HS super -, reduced organics, NH sub 3, and indirectly related to dissolved O sub 2. Oxygen levels greater than 2.4 mg/l would tend to suppress Cr(VI) reduction to Cr(III). Once reduced, Cr was rapidly removed from the water column by precipitation of insoluble Cr(OH) sub 3 or sorption of positive Cr(III) species by the sediments. Cr(III) oxidation was not significant with an observed rate of 1 ug/l-day. Zinc dynamics indicated a very high rate of Zn removal by sediments to levels approximated by solid phase equilibria. Due to the essentially complete reduction of Cr(VI), no toxic effect was observed upon benthic respiration. The results indicated the natural ability of the Summit Impoundment (and other impoundments) to attenuate concentrations of heavy metals in the Naugatuck River, particularly the redox active species, Cr, Cu, and Fe. Replication of experimental units in the TPAM study was found to be excellent on the water quality parameters measured, including trace levels of metals, and would suggest the usefulness of the technique in other water quality studies.

W83-00214

## MICROORGANISMS CAPABLE OF DEGRADING REFRACATORY HYDROCARBONS IN OHIO WATERS,

Dayton Univ., OH. Dept. of Microbiology.

J. J. Cooney.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108290. Price codes: A04 in paper copy, A01 in microfiche. Ohio Water Resources Center, Columbus, Report No 493X, December 1980. 65 p, 5 Fig, 11 Tab, 81 Ref. OWRT B-060-OHIO(1).

**Descriptors:** "Aliphatic hydrocarbons," "Organic compounds," "Microbial degradation," "Cultures," "Aquatic fungi," "Aquatic bacteria, Water quality, Sediment-water interfaces, Lakes, Hydrocarbons, Metabolism, Biotransformation, Organic matter, Biodegradation, Degradation, Decomposition, Chemical wastes, Chemical degradation, Organic carbon, Bacteria, "Ohio."

Research was carried out to assess the degradation of model recalcitrant hydrocarbons (RH) by freshwater ecosystem microorganisms, the emulsification and metabolism of hydrocarbons by such bacteria, and factors influencing hydrocarbon degradation in three Ohio freshwater lakes. Pristane, 1,13-tetradecadiene (TDD), cyclohexane, and benzene were used as RH models. Pristane was degraded in 14 of 35 water-sediment cultures by 5 of 21 bacteria and 11 of 14 fungi, indicating there are individual freshwater organisms which can degrade branched hydrocarbons. TDD was degraded in 22 of 35 water-sediment cultures by 3 of 14 fungi and none of 21 bacteria, indicating individual freshwater organisms and combinations of such can

degrade unsaturated hydrocarbons. Of 35 pure cultures, only one degraded benzene, while none degraded cyclohexane. Of 3 methods used to quantify emulsifying capacity, agitation followed by visual inspection gave the best results. Hydrocarbon appeared to induce emulsifier formation in 96% of 129 cultures isolated from freshwater lakes. A model is proposed for the role of emulsifier (s) in hydrocarbon utilization. Hydrocarbon degradation was nutrient-limited in the 3-lake study, but the reason for this was not obvious. Mixed microflora of these lakes can degrade hydrocarbons. (Zielinski-MAXIMA)

W83-00219

## THE EFFECTS OF THE DISPOSAL OF SEWAGE EFFLUENTS ON GROUNDWATER QUALITY IN THE UNITED KINGDOM, Water Research Centre (England).

For primary bibliographic entry see Field 5E.

W83-00220

## COLIFORM ATTACHMENT TO SUSPENDED PARTICLES IN STORMWATER, Michigan Univ., Ann Arbor. School of Public Health.

J. E. Schillinger, and J. J. Gannon.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108324. Price codes: A05 in paper copy, A01 in microfiche. Completion Report, January, 1982. 84 p, 16 Fig, 28 Tab, 131 Ref, 3 Append. OWRT A-111-MICH(1).

**Descriptors:** "Coliforms," "Suspended solids," "Stormwater," "Particulate matter," "Water quality, Bacteria, Microorganisms, Pathogens, Bacterial analysis, Water analysis, Sedimentation, Settling tanks, Filtration, Settling velocity, Storm runoff, Storm wastewater.

Fractional filtration and settling tests showed significant numbers of fecal coliforms (FC), Klebsiella sp. (KS) and Pseudomonas aeruginosa (PA) (15-30% of cells), to be associated with stormwater suspended particles. Most of these were associated with the 30-52 and greater than 52 micron fractions. The percentages of total filtered microorganisms retained on the 30 and 52 micron screens were for FC, KS, PA, and gram negative bacteria (GNB) were 80, 75, 68, and 87%, respectively. While large particles settled rapidly, sufficient numbers of single bacteria or aggregates less than 5 microns remain (above 50% of cells) to contribute to waterborne pollution, even after a 4-hour settling time. Significant differences were noted between adsorption of FC (16%) and pathogens KS and PA (26%), and between those groups and total GNB (37%) by retention on greater than 5 micron screens. Clay flocculation tests confirmed the lower adsorption/attachment rate of FC (E. coli used in lab tests), as observed in filtration and settling experiments; FC may not be ideal indicators of adsorption/settability, but should be viewed as conservation indicators since other bacteria/pathogens may be more associated with suspended particles. (Zielinski-MAXIMA)

W83-00224

## NITRATE CONTAMINATION OF GROUNDWATER ON THE OLD MISSION PENINSULA: CONTRIBUTION OF LAND RESHAPING AND SEPTIC DRAINFIELDS,

Michigan State Univ., East Lansing. Dept. of Crop and Soil Science.

B. G. Ellis.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108340. Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March 1982. 33 p, 2 Fig, 17 Tab, 12 Ref, 1 Append. OWRT A-119-MICH(1), 14-34-0001-1124.

**Descriptors:** "Nitrates," "Groundwater pollution," "Land forming," "Drainage effects," "Water quality standards, Land development, Subsurface drainage, Groundwater, Land use, Landscaping, Ter-racing, Septic sludge, Septic wastewater, Drainage water, Catchment areas, Drinking water, Soil porosity.

Research was carried out to determine the concentration of nitrate nitrogen in the soil with depth as affected by reshaping land surfaces, as well as its concentration leading from septic drainfields, in order to examine the movement of nitrate through soils as a result of reshaping soil surfaces and using septic drainfields. In both cases, nitrate values exceeding the drinking water standard were observed. However, the nitrate increases as a result of land reshaping were not considered to be a major source of groundwater contamination, since, in the worst case (heavy fill of top soil to a depth of 10 feet or more) nitrate should decrease with time. Septic systems were found to give 20-40 ppm nitrate nitrogen during all seasons of the year, which is 2-4 times the drinking water standard. This is expected to represent a serious contamination source, since it is not expected to be diluted by more than about half for the lot sizes in many of the Peninsula subdivisions. It may also become more of a problem in the future as nitrate content in the well water begins to rise. Nitrate nitrogen in deep profile soil samples (for reshaped land) and samples from lysimeters (for septic drainfields) was extracted, reduced to nitrite, and analyzed colorimetrically on an automatic analyzer. (Zielinski-MAXIMA)

W83-00228

## PRACTICAL TECHNIQUES OF RIVER MONITORING AND POLLUTION FORECASTING, Institute of Hydrology, Wallingford (England).

D. E. Caddy, and P. G. Whitehead.

Effluent and Water Treatment Journal, Vol 22, No 5, p 179-182, May, 1982. 4 Fig, 3 Tab, 5 Ref.

**Descriptors:** "Monitoring," "Forecasting," "Computers, Water pollution effects, Model studies, Telemetry, Remote sensing, Water pollution sources, Industrial wastes, Wastewater disposal.

The water quality monitoring and telemetry system established on the Bedford Ouse River System is described. An integral part of that system is the micro-computer based in Cambridge and used as a central processor to telephone the outstations, receive and store data and forecast water quality. The package of computer programs developed for the micro-computer provides a flexible system with which to monitor and forecast water quality conditions on the Bedford Ouse. The development of relatively cheap and reliable micro-computers has enhanced the capabilities of such systems, providing information of significant operational value to management. With the need to save capital resources in the future it is necessary to ensure good operational control of water quality in river systems, particularly along critical stretches of river such as the Bedford Ouse. The monitoring and forecasting scheme is one method of ensuring that the best information is available for management. The model developed for the Ouse is an operational one and is therefore designed to use time varying input measures of flow and water quality to compute time varying output responses. The model characterizes the short term system behavior and provides a mathematical approximation to the physicochemical changes in the river system. In one case of the Milton Keynes effluent the model provided valuable information for the management at the Clapham water abstraction plant and gave them effectively a four day warning. A second case study relates to the release of an unsatisfactory effluent from Bedford sewage works, which resulted in a significant pulse of ammonia being discharged to the river. (Baker-FRC)

W83-00238

## NON-POINT POLLUTION CONTROL FOR RANGELAND WINTERING, LIVESTOCK OPERATIONS (GROUND COVER), Idaho Univ., Moscow. Coll. of Engineering.

For primary bibliographic entry see Field 5G.

W83-00252

## NITRATE MOVEMENT AND DENITRIFICATION DEFINED RELATIVE TO BROMIDE TRACER IN TILE-DRAINED LAND,

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

Iowa State Water Resources Research Inst., Ames. J. L. Baker, H. P. Johnson, T. Fenton, J. O'Toole, and T. Grauer.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108035, Price codes: A07 in paper copy, A01 in microfiche. Completion Report ISWRRI-115, June, 1982, 118 p, 13 Fig, 19 Tab, 48 Ref, 3 Append. OWRT A-055-IA(1), 14-31-0001-5015.

Descriptors: \*Denitrification, \*Environmental tracers, \*Bromides, \*Soil water, \*Tile drainage, Tracers, Nitrates, Nitrogen cycle, Nitrogen, Nitrogen removal, Tagging, Leaching, Infiltration, Percolation, Tile drains, Nutrients, Nutrient removal.

A 3-year field experiment initiated in 1975 was designed to study the movement of nitrogen (N) as nitrate (NO<sub>3</sub>) and bromide (Br) through the soil profile and into tile lines, following application of N fertilizer and ammonium bromide. The study was carried out to assess the NO<sub>3</sub> leaching rate from the soil surface to the tile drains, to test the use of Br ion as a tracer, and to use the data to estimate the relevance of N transformation (e.g., mineralization, denitrification (DN), in the fate pathways of N. Tile drain water concentrations of both NO<sub>3</sub> and Br approached maximum nearly a year after fertilizer and bromide application (42 and 12 mg/liter, respectively); in this interval, about 325 mm water had flowed from the tile drains. Ratios of NO<sub>3</sub>/Br in tile drainage water decreased from 4.7-2.5 and from 2.5-0.26 for the two tiles used during a 14-month dry period. The decrease in NO<sub>3</sub> levels and in NO<sub>3</sub>/Br ratios with time was interpreted as being due to DN. These ratios also decreased in soil and soil water samples with time, also suggesting DN. Chemical balance for NO<sub>3</sub> and leach loss data were obtained. Since no plant uptake of N occurred in the fallow study area, DN of NO<sub>3</sub> appeared to be at least 200 kg/ha (of 390 kg/ha present following chemical application). (Zielinski-MAXIMA) W83-00264

#### A PRELIMINARY STUDY OF NATURAL AQUIFER DISCHARGE OF GUAM,

Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.

W. J. Zolan.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108100, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No 34, August, 1982, 47 p, 7 Fig, 2 Tab, 14 Ref, 4 Append. OWRT A-022-GUAM(1), 14-34-0001-1112.

Descriptors: \*Groundwater movement, \*Groundwater pollution, \*Guam, \*Aquifer characteristics, \*Water analysis, Natural flow, Natural resources, Natural streams, Aquifers, Seawater, Groundwater depletion, Water sampling, Nutrients, Nitrates, Chlorophyll, Coliforms.

The quality of groundwater seeps along the northern coast of Guam was studied to ascertain the presence of major regional differences. Water samples were collected and analyzed bimonthly over an 8-month period from groundwater seepage, springs, three caves, and an open sink hole. Marine waters about 5 m outward were analyzed for inorganic nutrients, chlorophylls a/b/c, and carotenoids. Results indicated that shoreline seepage averages 6-7% seawater, based on chloride and sulfate concentrations, while larger springs have 2-3% seawater. Caves and the sink hole averaged 3% seawater. Thus, very little dilution with seawater occurs prior to groundwater discharge at the surface. Nitrate-nitrogen NO<sub>3</sub>-N) levels are in the same range as most well groundwater (1-2 mg/liter NO<sub>3</sub>-N). Other inorganic nutrients (ammonia- and nitrite-nitrogen, and phosphate-phosphorus) were also similar to typical groundwater levels. Further, coliform bacteria were few/zero in almost all samples. Marine water adjacent to groundwater seepage areas had higher chlorophyll (chlorophyll a averaged 1.0 mg/cu m) and carotenoids than waters in the same area removed from shore. Nutrient levels (especially NO<sub>3</sub>-N) often exceeded the established water quality standard (0.20 mg/liter for NO<sub>3</sub>-N). Shoreline seeps at three points had the greatest variability due to the effect of tidal

height and surf condition differences; other sampling stations gave more consistent results. (Zielinski-MAXIMA) W83-00271

#### THE FLOW OF SLURRY FROM A BREACHED TAILINGS DAM.

University of the Witwatersrand, Johannesburg (South Africa). Dept. of Construction Materials. For primary bibliographic entry see Field 8B. W83-00285

#### PERSISTENCE IN MODEL ECOSYSTEMS,

Georgia Univ., Athens. Dept. of Mathematics.

T. C. Gard.

Available from the National Technical Information Service, Springfield, VA 22161 as PB82-196916, Price codes: A02 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-82-030, May 1982, 2 p.

Descriptors: \*Ecosystems, \*Mathematical models, \*Fate of pollutants, \*Persistence, Water pollution effects, Nutrients, Food chains, Toxic substances.

Mathematical models aid in understanding environmental systems and in developing testable hypotheses relevant to the fate and ecological effects of toxic substances in such systems. Within the framework of microcosm or laboratory ecosystem modeling, some differential equation models, in particular, become tractable to mathematical analysis when the focus is on the problem of persistence. In this report, a hierarchy of microcosm-related models, the top level of which contains a nutrient-producer-grazer food chain, and general food chains are analyzed for persistence. The results, which take the form of inequalities involving model parameters, specify necessary conditions and sufficient conditions for continued presence of the model components throughout indefinite time intervals. These results can serve as a basis for preliminary evaluations of model performance. (Author's abstract) W83-00294

#### STREAM WATER NUTRIENT CHANGES ASSOCIATED WITH THE CONVERSION OF ARIZONA CHAPARRAL,

Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.

E. A. Davis.

In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 333-338, 3 Tab, 4 Ref.

Descriptors: \*Nitrates, \*Chaparral, \*Brush control, \*Water yield improvement, \*Water pollution sources, Nutrients, Herbicides, Leaching, Vegetation, Grasslands, Eutrophication, Watershed management, \*Arizona.

Streamflow from chaparral watersheds in Arizona can be increased under certain conditions by converting brush to grass. This increased streamflow is associated with increased nitrate concentrations in the stream water. Undisturbed chaparral watersheds are tight with respect to nitrogen, losing very little nitrate-nitrogen in streamflow; nitrate concentrations are usually less than 0.5 ppm. Converting chaparral watersheds from deep-rooted shrubs to shallow-rooted grasses through the use of herbicides allows the escape of nitrate ions through the soil mantle. Nitrate concentrations of 45-80 ppm occurred in stream water from treated watersheds; nitrate concentrations remained above normal for 10 years or more. For the first few years, the pattern of nitrate concentration followed a wave form in which nitrate increased only after rainstorms of sufficient duration and amount to leach nitrates through the regolith into base flow. During the second stage, nitrate concentrations in the stream water remained 10 to 100 times above normal, with rainfall conditions adequate to sustain increased water yields. Some possible effects of the nitrate-release phenomenon are eutrophication of streams and reservoirs, loss of watershed soil fertil-

ity, and unsuitability of stream water for drinking purposes. (Moore-SRC) W83-00300

#### INFLUENCE OF PRESCRIBED BURNING ON NUTRIENT BUDGETS OF MOUNTAIN FYNBOS CATCHMENTS IN THE S. W. CAPE, REP. OF SOUTH AFRICA,

Jonkershoek Forest Research Station, Stellenbosch (South Africa).

D. B. Van Wyk.

In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 390-396, 3 Fig, 5 Tab, 12 Ref.

Descriptors: \*Prescribed burning, \*Nutrients, \*Precipitation, \*Water quality, \*Sediment load, \*South Africa, Sodium, Chloride, Floods, Streams, Load management.

The nutrient budgets of the Western Cape Mountain fynbos areas of the Republic of South Africa have been the subject of investigations since 1971. The average nutrient input (120 kg/ha/yr) exceeds the output (96 kg/ha/yr) by 29%. Because in this case the main source of nutrients in precipitation is the sea, heavy loads of Na and Cl are deposited into the fynbos areas. The other constituents of precipitation are K, Ca, Mg, Cl. Traces of HC<sub>03</sub> and SO<sub>4</sub> were found, while no traces of N and P were detected. The constituents in streamflow were present in the same ratio as in precipitation. The influence of prescribed burning in different seasons on stream water quality was also investigated. Results indicate that nutrient release as a result of prescribed burning does not persist beyond the first winter after burning. The month in which burning takes place has an influence in this respect. It was found that the net release of nutrients takes place during the first two floods after the burn. There is no marked increase in sediment loads of the streams after burning. (Author's abstract) W83-00304

#### POLYCYCLIC AROMATIC HYDROCARBONS IN SEWAGE, MUSSELS AND TAP WATER,

Central Inst. for Industrial Research, Oslo (Norway).

K. Kveseth, B. Sortland, and T. Bokn. Chemosphere, Vol 11, No 7, p 623-639, July, 1982, 5 Fig, 4 Tab, 22 Ref.

Descriptors: \*Polycyclic aromatic hydrocarbons, \*Drinking water, \*Bioaccumulation, \*Treated water, Water quality standards, Wastewater treatment, Mussels, Gas chromatography, Water pollution effects, Norway, Finland, Sweden.

Polycyclic aromatic hydrocarbon levels were determined in treated sewage water, in drinking water supplies from Norway, Finland, and Sweden; in mussels grown in polluted and unpolluted waters; and in Norwegian tap water. Glass capillary gas chromatograph y was used to identify up to 30 PAH compounds. PAH levels were below the standard recommended by WHO in all potable waters tested. The samples collected near a water treatment plant outlet in a rainwater collecting basin showed slightly higher levels. Sewage discharge water had concentrations of 0.8 to 7.7 micrograms/liter and tap water had 0.002 to 0.2 micrograms/liter. Mussels had concentrations from 0.5 to 1.1 micrograms/liter, and accumulation in mussels seemed to be rather slow. (Small-FRC) W83-00330

#### THE FATE OF 2,4,6-TRICHLOROPHENOL IN AN AQUATIC CONTINUOUS-FLOW SYSTEM,

Jyväskylä Univ. (Finland). Dept. of Cell Biology.

M. T. Virtanen, and M-L. Hattula. Chemosphere, Vol 11, No 7, p 641-649, July, 1982, 2 Tab, 12 Ref.

Descriptors: \*Toxicity, \*Fish toxins, \*2,4,6-Trichlorophenol, \*Bioaccumulation, Hazardous materials, Sediment, Flora, Snails, Bleaching wastes,

## Effects Of Pollution—Group 5C

Fish, Water pollution effects, Gas chromatography, Industrial wastes, \*Finland, Teratogenesis, \*Phenols.

The toxicity of 2,4,6-trichlorophenol (TCP) to fish was evaluated, and the bioaccumulation of 2,4,6-TCP in sediment and several aquatic organisms was studied. Gas chromatography was used to determine 2,4,6-TCP levels in oedogonium, echinodorus, elodea, limnea, poecilia, and asellus kept in a flow-through glass aquarium where water contained 5 ppb TCP. Rapid take-up was observed in plants, snails, and fish. Young born to test fish had a high incidence of curvature of the spine and a high death rate. Thus, TCP may be a potent teratogen. 2,4,6-TCP is a typical residue from chlorine bleaching and is contained in wood preservatives. (Small-FRC) W83-00332

### 5C. Effects Of Pollution

**MUNICIPAL POINT SOURCE AND AGRICULTURAL NONPOINT SOURCE CONTRIBUTION TO COASTAL EUTROPHICATION,** Tennessee Valley Authority, Knoxville, TN. For primary bibliographic entry see Field 5B. W83-00001

**AEROBIC DEGRADATION OF DIURON BY AQUATIC MICROORGANISMS,** Clemson Univ., SC. Dept. of Microbiology. For primary bibliographic entry see Field 5B. W83-00002

**CONTROL OF LAKE PHOSPHORUS WITH ALUMINUM SULFATE: DOSE DETERMINATION AND APPLICATION TECHNIQUES,** Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. R. H. Kennedy, and G. D. Cooke. Water Resources Bulletin, Vol 18, No 3, p 389-395, June, 1982. 6 Fig, 1 Tab, 30 Ref.

Descriptors: \*Phosphorus removal, \*Lake sediments, \*Eutrophic lakes, \*Nuisance algae, \*Aluminum sulfate, Phosphorus, Chemical precipitation, Lakes, Reservoirs, Water quality control, Eutrophication, Turbidity, Nutrients, Nutrient removal, Cycling nutrients.

Some types of lakes and reservoirs will experience nuisance algal blooms despite nutrient diversion due to recycling of phosphorus (P) from sediments. In order to control P release from sediments and remove P from the water column, the P precipitation/inactivation technique using aluminum sulfate may be applied. A method for calculating the proper aluminum dose is suggested which emphasizes long term control of P recycling from bottom sediments. The dose can be calculated directly from water alkalinity and a scale for alum applications to lakes and reservoirs can be established by titration of water samples of varying alkalinity. Application methods and equipment vary with treatment objectives and include lakeside storage, a distribution pipe, and an application barge and manifold. Alum treatment may also be employed to handle problem flows and reduce particulate concentrations and lake turbidity. (Geiger-FRC) W83-00006

**MASS BALANCE MODEL ESTIMATION OF PHOSPHORUS CONCENTRATIONS IN RESERVOIRS,** Bureau of Reclamation, Denver, CO. Engineering Research Center. D. K. Mueller. Water Resources Bulletin, Vol 18, No 3, p 377-382, June, 1982. 6 Fig, 7 Tab, 15 Ref.

Descriptors: \*Water quality control, \*Phosphorus, \*Eutrophication, \*Model studies, \*Reservoirs, Mathematical models, Lakes, Water quality management, Artificial lakes, Nutrients, Mathematical studies.

Mass balance models are useful tools in the control of phosphorus induced eutrophication of lakes, but

their applicability to reservoirs, especially those of the Western United States, has not yet been verified. Using data from the United States Environmental Protection Agency National Eutrophication Survey, such a verification was attempted for 68 reservoirs from 11 Western states. Several models commonly used in lake quality assessments were compared for accuracy in application to the reservoir data by model standard error and correlation between estimated and observed reservoir phosphorus concentrations. The model of Dillon and Rigler, which uses phosphorus retention calculated from observed data, proved the most accurate with a correlation coefficient of 0.86 and a standard error of 0.2, based on logarithmic transformed values. Other models considered included the Vollenweider-1975 model which assumes a constant settling velocity, the Jones-Bachmann model which assumes a constant sedimentation coefficient, the Dillon-Kirchner model which estimates phosphorus retention as a function of hydraulic load, and the Vollenweider-1976 model which estimates phosphorus flushing from the inverse of hydraulic detention. These models displayed deficiencies in model formulation and in coefficient adaptation to lake data. (Geiger-FRC) W83-00009

**THE INCIDENCE OF VIBRIO CHOLEREA IN WATER, ANIMALS AND BIRDS IN KENT, ENGLAND,** Preston Hall Hospital, Maidstone (England). Public Health Lab. For primary bibliographic entry see Field 5B. W83-00012

**DISTRIBUTION OF DENITRIFYING BACTERIA AND ITS CONTROLLING FACTORS IN FRESHWATER ENVIRONMENTS,** Tokyo Metropolitan Univ. (Japan). Dept. of Biology. T. Nakajima. Japanese Journal of Limnology, Vol 43, No 1, p 17-26, January, 1982. 8 Fig, 1 Tab, 27 Ref.

Descriptors: \*Bacteria, Natural waters, \*Denitrification, Lakes, \*Denitrifying bacteria, Rivers, \*Japan, Pseudomonas, Eutrophication, Ponds, Stratification, Nitrogen removal, Limnology.

Factors affecting the distribution of denitrifying bacteria and the genera of these bacteria in freshwater environments are investigated. The water environments studied included Himon-ya Pond, located in a small metropolitan park in Tokyo with little inflow except rainwater; Lake Kasumigaura and Lake Kitaura with areas of 178 and 78.8 sq km, respectively; Lake Suwa with an area of 14.5 sq km and a maximum depth of 7 m; Lake Nakamura, which is a small eutrophic lake surrounded with paddy fields; and the River Tamagawa, located at the southwest part of Tokyo. The three study sites on the River Tamagawa ranged from slightly polluted to heavily polluted with municipal sewage. The denitrifying bacterial population fluctuated greatly in both non-stratified and stratified eutrophic lake waters, although the aerobic heterotrophic bacteria varied little. In non-stratified eutrophic lakes the number of denitrifying bacteria tended to increase as the amount of total nitrogen in water increased. The amount of total nitrogen indicates the degree of lake eutrophication. In a stratified eutrophic lake the ratio of the number of denitrifying bacteria to that of aerobic heterotrophic bacteria (D/Aeh) tended to increase as the concentration of dissolved oxygen decreased. Denitrifying bacteria in both water and attached substances in a polluted river tended to increase in number with the increase in biochemical oxygen demand. The D/Aeh ratio in water and attached substances was higher than 0.01. Almost all denitrifying bacteria detected in the Himon-ya Pond, Lake Nakamura and the River Tamagawa were gram-negative. Pseudomonas was the genus most frequently isolated from every water type and attached substance. (Baker-FRC) W83-00018

**OBSERVATIONS ON THE BIOACCUMULATION POTENTIAL OF THORIUM AND URA-**

**NIUM IN RAINBOW TROUT (SALMO GAIRDNERI),** Pacific Northwest Lab., Richland, WA. Dept. of Ecological Sciences.

T. M. Poston. Bulletin of Environmental Contamination and Toxicology, Vol 28, No 6, p 682-690, June, 1982. 1 Fig, 5 Tab, 12 Ref.

Descriptors: \*Radioactive wastes, \*Thorium, \*Uranium, \*Trout, \*Bioaccumulation, Path of pollutants, Water pollution sources, Nuclear powerplants, Radioisotopes, Adsorption, Accumulation, Fish, Ecological effects, Powerplants.

The continued use of uranium (U) and the potential use of thorium (Th) as nuclear reactor fuels in powerplants may result in increased amounts of these actinides in aquatic ecosystems. A study was conducted to determine if uptake of U or Th occurs at significant rates in juvenile rainbow trout and to assess how soluble and particulate partitioning affects the uptake behavior of these actinides. Th rapidly partitioned into soluble and particulate fractions when mixed with Columbia River water, while all U measured in the water column represented the soluble fraction. Total body burdens of Th varied during both uptake and depuration but represented mostly either gut loading or surface adsorption of Th. Gut loading was also probably responsible for the wide variations in U body burdens during the uptake phase. At higher U concentrations, the actinide was incorporated into the tissue of the fish. Depuration results suggested that both Th and U become tissue bound, but most of the body burdens during uptake could be attributed to gut loading. Concentration ratios indicated a low propensity for Th and U accumulation in fish tissues. (Geiger-FRC) W83-00021

**A PRINCIPAL COMPONENTS ANALYSIS OF THE PHYTOPLANKTON FROM A POND IN THE PARANA RIVER VALLEY, ARGENTINA,** Instituto Nacional de Limnología, Santo Tome (Argentina).

M. O. Garcia de Emiliani, and P. J. Depetris. Hydrobiologia, Vol 89, No 2, p 117-122, April, 1982. 3 Fig, 1 Tab, 20 Ref.

Descriptors: \*Ponds, \*Multivariate analysis, \*Phytoplankton, Physical properties, Biological properties, Chemical properties, Mathematical studies, Statistical analysis, Seasonal variation, Lotic environment, Lakes, Limnology, River basins, \*Argentina, Parana River, Alluvial plains, Water level.

The present study represents the first study in a series evaluating the relative importance of ecological factors on selected ponds of the middle Parana alluvial plain. Multivariate statistical analyses were used to reveal the ecological factors that generate the variability observed in the 10 physical, chemical and biological (phytoplankton) parameters measured in Los Matadores pond. Samples were taken from the superficial layer of the pond's center. The parameters selected for study included depth, water temperature, pH, primary productivity, specific diversity, and the concentrations of nitrates, phosphates, silica, cells, and chlorophyll a. Results from 42 analyzed samples showed that 82.1% of the total variance in the data is accounted for by the first three components of the principal components analysis: the lotic influence (58.3% of the variance), the seasonal cycle (16.4%), and the degree of pond maturity (7.4%). (Geiger-FRC) W83-00022

**APPLICABILITY OF PHOSPHORUS BUDGET MODELS TO SOUTHERN AFRICAN MAN-MADE LAKES,** National Inst. for Water Research, Pretoria (South Africa). Limnology Div.

J. A. Thornton, and R. D. Walmsley. Hydrobiologia, Vol 89, No 3, p 237-245, May, 1982. 4 Fig, 3 Tab, 45 Ref.

Descriptors: \*Phosphorus, \*Model studies, \*Artificial lakes, \*Eutrophication, Trophic level, Lakes, Mathematical models, Mathematical studies, Mu-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

municipal wastewater, Prediction, \*South Africa, Retention, Catchments, Water management.

A study was made of the phosphorus (P) loading in 31 southern African man-made lakes that were characterized by low retention time (< 1 yr). Catchment P export rates varied widely from those of lakes subject to excessive inputs of municipal wastewater having export rates of 53 milligrams/sq m/yr. The P data was tested against two P budget models for predicting in-lake steady state P concentrations. The Vollenweider eutrophication model (1976) relates the steady state in-lake P level to P loading and water retention time. The Dillon and Rigler model describes the steady state P level in a lake based on its P loading, flushing rate, mean depth, and P retention. Both models displayed good potential for predicting steady state P concentrations, but the Dillon and Rigler model gave slightly better results. In lakes where P levels are not necessarily related to trophic state, other models may be needed as predictive tools for eutrophication control. (Geiger-FRC)

W83-00025

#### EXISTENCE OF PHYTOPLANKTON IN SPIRIT LAKE NEAR ACTIVE VOLCANO MT. ST. HELENS, WASHINGTON, U.S.A.: POST-ERUPTION FINDINGS,

Army Engineer District, Portland, OR.

D. W. Larson, and N. S. Geiger.

Archiv für Hydrobiologie, Vol 93, No 3, p 375-380, February, 1982. 1 Fig, 3 Tab, 16 Ref.

Descriptors: \*Volcanoes, \*Lake restoration, \*Phytoplankton, \*Spirit Lake, \*Mt. St. Helens, \*Washington, Diatoms, Water quality, Species composition, Algae, Water pollution effects, Lakes, Phosphorus, Nitrates, Limnology, Organic compounds.

Phytoplankton highly tolerant to adverse water conditions were present during August and October 1980 in Spirit Lake, which had been choked with volcanic debris and logs and heated to over 40°C during the eruption of Mt. St. Helens, Washington, in May 1980. Thirteen species of diatoms were found during the October 21, 1980, sampling. *Cyclotella stelligera* accounted for 26% of the total density; *Stephanodiscus astraea*, 22%; *Fragilaria construens*, 17%; and *Melosira distans*, 8%. Total densities were 260,000 units per liter. Water quality in October was slightly improved over that observed in August, but was high in phenolics, 0.78 mg per liter. Specific conductivity was 679 micromhos per cm; temperature, 13°C. In August color was 400 platinum cobalt units; total phosphorus, 0.26 mg per liter; dissolved oxygen, 0.45 mg per liter; and nitrate, 2 mg per liter. These findings suggest that lake recovery is underway in spite of the extreme perturbation. (Cassar-FRC)

W83-00026

#### PALEOECOLOGICAL STUDIES OF THE RECENT DEVELOPMENT OF THE LAKE VAXJOSJÖN. IV. INTERPRETATION OF THE EUTROPHICATION PROCESS THROUGH THE ANALYSIS OF SUBFOSSIL CHIRONOMIDS,

Uppsala Univ. (Sweden). Dept. of Entomology. Y. Brodin.

Archiv für Hydrobiologie, Vol 93, No 3, p 313-326, February, 1982. 2 Fig, 2 Tab, 33 Ref.

Descriptors: \*Eutrophication, \*Midges, Sediments, Water pollution effects, Eutrophic lakes, Lakes, Shallow water, Oxygen depletion, Lake Vaxjösjön, \*Sweden, \*Fossils, \*Lake sediments, Organic matter, Benthic fauna, \*Paleolimnology, Species distribution, Wind.

The eutrophication of shallow Lake Vaxjösjön, Sweden, was traced for 700 years through examination of subfossil littoral chironomid remains in a 2.5 m core taken from the deepest part of the lake. In general, the structure of the chironomid community depended on food availability and oxygen conditions. The first zone, below 170 cm depth, covered 500 years of moderate change, ending in 1814, when the lake level lowered. The second zone, 170-110 cm depth, represented increased erosion and human activity. Sediment from the third

period, 1910-1965, was black as a result of culturally induced oxygen deficits. A total of 1476 head capsules were found in the core. They belonged to 31 genera and 50 species. *Glyptotendipes* and *Cricotopus* were most abundant, followed by *Tanytarsus*, *Chironomus*, and *Polydiplos*. The fauna associated with eutrophic conditions were found throughout the core, but 23 species were not found in the shallowest, most eutrophic zone 3. No taxa representing oligotrophic conditions were found in zone 3. Results indicated that the lake was already eutrophic in 1300 A. D. The increasing diversity and occurrence of polyoxybiontic species showed that oxygen conditions had improved in the sediments up to about 1800, probably from cutting the surrounding forest and opening the lake to wind action. Eutrophication increased markedly until 1930, as reflected in strong changes in the structure of the chironomid com. The chironomid fauna indicated improved environmental conditions. (Cassar-FRC)

W83-00028

#### INDUCTION OF HIGH PHOSPHATASE ACTIVITY BY ALUMINUM IN ACID LAKES,

Uppsala Univ. (Sweden). Inst. of Limnology.

For primary bibliographic entry see Field 5B.

W83-00029

#### EFFECTS OF THE BURROWING MAYFLY, HEXAGENIA, ON NITROGEN AND SULFUR FRACTIONS IN LAKE SEDIMENT MICRO-COSMS,

State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse. Dept. of Environmental and Forest Biology.

G. B. Lawrence, M. J. Mitchell, and D. H. Landers.

Hydrobiologia, Vol 87, No 3, p 273-283, March, 1982. 7 Fig, 2 Tab, 30 Ref. OWRT B-096-NY.

Descriptors: \*Mayflies, Sediments, \*Nitrogen compounds, \*Sulfur compounds, \*Hexagenia, Metabolism, Invertebrates, \*Lake sediments, Oxidation-reduction potential, Hydrogen ion concentration, Chemical reactions, Ammonia, Nitrates, Sulfates, Decomposition, Bioturbation, \*New York, Deer Lake.

The effects of the burrowing mayfly, *Hexagenia*, on the chemistry (nitrogen and sulfur pools) of sediment and overlying water were determined in the laboratory. Of the 27 glass jars containing water and sediment from Deer Lake (Adirondacks), 9 had 2 live *Hexagenia* nymphs each, 9 had 2 dead *Hexagenia* each, and 9 had no animals added. In the live microcosm sediment redox potential (Eh) increased 1.98 + or - 0.486 mV per day, sediment pH decreased 0.007 + or - 0.001 per day, water pH decreased 0.024 + or - 0.004 per day, sediment ammonia increased 5.46 + or - 0.14 ppm N per day, and water ammonia increased 0.792 + or - 0.154 ppm N per day. There were no increases in the control Eh, pH, or ammonia concentrations. Water Eh increased 1.95 + or - 0.410 mV per day in all microcosms. Sediment nitrate increased 0.202 + or - 0.081 ppm N per day in the live microcosm, 0.017 + or - 0.05 ppm N per day in the control, and did not change in the dead microcosms. The sulfate fraction of the sediment (0.017 + or - 0.006% dry mass) and water (50.0 + or - 4.9 ppm per liter) in *Hexagenia* microcosms was greater than in the control (0.151 + or - 0.005% dry mass and 14.7 + or - 1.71 mg per liter) at the end of the 54-day experiment. Zn-HCl reducible inorganic sulfur decreased in all microcosms, with the live environment showing the greatest decrease (7.1 + or - 1.5 S per day). There was a general increase in inorganic S and ester sulfate, 7.2 + or - 6.9 ppm S per day. In general the dead microcosms produced results similar to the control. Increased redox potential and decreased pH were a result of increased dissolved oxygen concentrations and metabolic activity. The rapid ammonia increase was a result of excretion by the nymphs, and the nitrate increases were due to nitrification of ammonia. (Cassar-FRC)

W83-00030

#### DISTRIBUTION OF CHIRONOMIDS IN THE LITTORAL ZONE OF LAKE TEXOMA, OKLAHOMA AND TEXAS,

Oklahoma Univ., Norman. Dept. of Zoology.

For primary bibliographic entry see Field 2H.

W83-00031

#### THE STRUCTURE AND SOME RECENT CHANGES OF THE ZOOBENTHIC COMMUNITY IN THE ERMATINGER BECKEN, A SHALLOW LITTORAL PART OF LAKE CONSTANCE,

Zululand Univ. (South Africa). Dept. of Botany.

For primary bibliographic entry see Field 2H.

W83-00036

#### THE RECENT HISTORIES OF THREE CANADIAN SHIELD LAKES: A PALEOLIMNOLOGICAL EXPERIMENT,

Queen's Univ., Kingston (Ontario). Dept. of Biology.

J. P. Smol, and M. D. Dickman.

Archiv für Hydrobiologie, Vol 93, No 1, p 83-108, November, 1981. 14 Fig, 1 Tab, 44 Ref.

Descriptors: \*Road construction, \*Algae, \*Paleolimnology, Water pollution effects, Found Lake, Jake Lake, Delano Lake, \*Canada, Phytoplankton, Diatoms, Lakes, Turbidity, Sediments, Lake sediments, Nutrients, Limnology, Organic matter, Algonquin Provincial Park, Construction, Carbonates, \*Shield lakes.

Paleolimnology was used to compare the effects of cultural disturbances in 3 small lakes with very small watersheds in Algonquin Provincial Park, Ontario. Found Lake and Jake Lake were subjected to the impacts of roadbuilding in 1933, followed by paving in 1948 and construction of a park museum in 1953. Delano Lake, relatively free of such influences, served as a control. The top 20 cm of the lake sediment was studied at 1 cm intervals for fossil diatoms, pollen grains, phosphorus, organic matter, and carbonate. As a result of increased water turbidity following road construction the diatom *Syndra delicatissima* var. *angustissima* increased in Found Lake, replacing the tychoplankton *Cyclotella stelligera*. The diatom assemblage returned to preconstruction conditions in the early 1940's. The subsequent construction in 1953 caused another decline in tychoplankton and replacement by *Asterionella formosa* and *Cyclotella comta*. Jake Lake, possessing a well-developed littoral zone, showed similar changes following road construction, except that *Pinnularia biceps* was probably favored by the increased nutrient levels in Jake Lake. Sediments from Delano Lake showed no such fluctuations in diatom or phytoplankton assemblages. (Cassar-FRC)

W83-00042

#### IMPACT OF CHROMIUM TO THE POPULATION DYNAMICS OF TISBE HOLOTHURIAE,

Athens Univ. (Greece). Zoological Lab. and Museum.

G. Verriopoulos, and M. Moraitou-

Apostolopoulou.

Archiv für Hydrobiologie, Vol 93, No 1, p 59-67, November, 1981. 2 Fig, 2 Tab, 19 Ref.

Descriptors: \*Chromium, \*Toxicity, \*Population dynamics, Water pollution effects, Heavy metals, Metals, Sublethal effects, \*Copepods, \*Tisbe holothuria, Embryonic growth stage, Eggs, Growth stages, Invertebrates.

The harpacticoid copepod *Tisbe holothuria* was exposed to chromium levels of zero (control), 0.5, 1, and 2 mg per liter in water to determine the longevity of the parent (F2), longevity of the offspring (F3), number of egg sacs produced by the F2 generation, the interval between the formation of 2 successive sacs, the percentage of egg sac abortions, and numbers of F3 offspring. Survival of the F2 *Tisbe* was significantly affected at 1 and 2 mg per liter Cr, reduced to 9.9 + or - 0.63 days at 2 mg per liter concentration vs. 22.5 + or - 7.64 days for the controls. The F3 generation was more sensitive to Cr, surviving only 2 days at 2 mg per liter Cr. Number of egg sacs decreased with in-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

creasing Cr concentration from 5.86 + or - 2.09 per female in the control to 1.41 + or - 0.63 at the 2 mg per liter concentration. No statistically significant difference was seen in the time needed for formation of a new egg sac in Tisbe exposed to all Cr concentrations. Abortion of egg sacs reached 88.8 + or - 29.9% at the 1 mg per liter Cr level and 96.88 + or - 27.18% at the 2 mg per liter level, compared with 36.9 + or - 28.2% in the controls. The number of F3 offspring per animal was 110.2 + or - 17.2 in controls and 6.6 + or - 1.2 at the 2 mg per liter Cr level. Tisbe grown in uncontaminated water took 12 days to develop from egg to adult, but those exposed to 0.5 mg per liter Cr took 20 days. Although exposure levels of Cr in this study were much less than the LC50 (17.36 mg per liter, 48 hours), significant damage was done to the Tisbe population by destroying animals in the embryonic stages, by inhibiting sexual maturation, and by prolonging the development period. (Cassar-FRC)

W83-00043

#### THE SEDIMENTS OF THE NEW ARTIFICIAL LAKE BOSTALSEE (SAARLAND, GERMANY), WITH PARTICULAR REFERENCE TO MICROBIAL ACTIVITY,

Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Dept. of Microbiology.

U. Zais.

Archiv fur Hydrobiologie, Vol 92, No 3, p 346-358, October, 1981. 7 Fig, 1 Tab, 18 Ref.

Descriptors: Sediments, \*Eutrophic lakes, \*Bacteria, \*Eutrophication, \*Lake sediments, Methane, Reservoirs, Lake Bostalsee, Anaerobic conditions, Sulfides, Sulfates, Sulfur bacteria, Nutrients, Micro-organisms, Heterotrophic bacteria, Iron, Phosphates, Nitrogen compounds, Water pollution effects, Benthic flora, Intersitial water, Organic matter, Wastewater pollution, Nutrients, Oxidation-reduction potential, Dehydrogenase, Enzymes, Seasonal variation, \*West Germany.

The sediments of Lake Bostalsee, north Germany, were investigated during 1979-80 to evaluate the future of the lake. This 1.19 sq km artificial lake was impounded in 1977 without removing the rich agricultural soil. In 1977 untreated raw sewage escaped through a broken main under the lake for several months, producing a massive algal bloom during 1978. Two locations were examined, Site I in the shallow southwest and Site II, at maximum depth, 17 m. Redox potentials of the sediment were high in spring at both stations (+100 to +200 mV), decreasing to about -200 mV in August. The iron-rich interstitial water in the profundal sediments reached a maximum concentration of about 2 nmol Fe per liter during summer stratification. Phosphates, ammonium, and Kjeldahl nitrogen were higher in deep water sediments in summer and fall, nitrates and nitrites were higher in spring. Counts of aerobic, heterotrophic bacteria averaged 4.3 million per g wet sediment, increasing to 160 million per g sediment in August. Hydrogenase and dehydrogenase activities followed the same trends. Methane (average composition 40.8% methane and 57.7% nitrogen gas) was generated in summer and autumn when the redox potential was below -100 mV, mostly in the profundal zone. Sulfate concentrations were 0.18-0.13 nmol per liter in spring, decreasing to 0.07-0.08 nmol per liter by October. Sulfides were maximum (4.1 nmol per kg) at the end of stratification in October. The unusually low redox potential in summer and resulting anaerobic conditions were a result of the high organic carbon content, a source of energy for the heterotrophic organisms. Sulfate-reducing bacteria were very active. (Cassar-FRC)

W83-00048

#### CHARACTERIZATION OF ACID PHOSPHATASES IN THE ACIDIFIED LAKE GARDJON, SWEDEN,

Uppsala Univ. (Sweden). Inst. Limnology.

M. Jansson, H. Olsson, and O. Broberg.

Archiv fur Hydrobiologie, Vol 92, No 3, p 377-395, October, 1981. 4 Fig, 7 Tab, 23 Ref.

Descriptors: \*Acidic water, Lakes, \*Enzymes, Water pollution effects, Acid rain, Lake Gardsjön,

\*Sweden, \*Phosphatases, Seston, Phosphates, Oligotrophic lakes, Bacteria, Algae, Nutrients, Phosphorus.

The effect of acidification on phosphorus metabolism was studied in Lake Gardsjön, Sweden. The bedrock in the catchment consists mainly of granites, and consequently the soil has weak buffering capacity. This, coupled with acid rainfall, accounts for the very low pH of lake waters. Phosphomonoesterase activity in the oligotrophic lake, pH 4.6, measured in spring and early summer 1980, was 10 times higher than in other Swedish lakes. Budget calculations showed that phosphatase production occurred mainly within the lake and was not derived from external sources. Activities (nmol phosphate per liter per min) were: epilimnion, 0.9-10.5; metalimnion, 2.7-18.0; hypolimnion, 0.6-12.0; inlet, 2.4-25.9; outlet, 1.4-7.5; artificial dams, 0.4-2.4; and tributary lake, 3.5-20.2. Four different phosphatases were found. All of these were associated with the seston and two were in dissolved form. All were strictly acid with optimum pH of 5. Most of the seston-bound phosphatase activity was in particles less than 5 microns. The main contributors to phosphatase activity were small algae and bacteria; possibly some larger algae secreted dissolved enzymes. Phosphate competitively inhibited the 3 dominant phosphatases. The phosphatases remained active for at least 5 days in sterile filtrates. The acid phosphatase system in this lake is apparently an adaptation to low pH in an environment with severely limited phosphorus supply (6.1 micrograms per liter total P). (Cassar-FRC)

W83-00050

#### STORAGE OF CARBON AND TRANSPORT OF OXYGEN IN RIVER MACROPHYTES: MASS-BALANCE, AND THE MEASUREMENT OF PRIMARY PRODUCTIVITY IN RIVERS,

Miljostyrelsen, Silkeborg (Denmark). Freshwater Lab.

For primary bibliographic entry see Field 5B.

W83-00051

#### SEASONAL ABUNDANCE OF CERATIUM HIRUNDINELLA, (O.F. MULLER) SCHIRANK IN LAKES OF DIFFERENT TROPHY,

Alberta Environmental Center, Vegreville.

J. W. Moore.

Archiv fur Hydrobiologie, Vol 92, No 4, p 535-548, November, 1981. 5 Fig, 4 Tab, 24 Ref.

Descriptors: Lakes, \*Nutrients, \*Phytoplankton, Water pollution effects, \*Ceratium hirundinella, \*Eutrophic lakes, \*Oligotrophic lakes, \*Eutrophication, Dinoflagellates, Algae, Subarctic zone, \*Canada, Trophic level, Seasonal variation, Vertical distribution, Algal growth, Nutrients, Light intensity, Climatic zones, Mesotrophic lakes, Light penetration, Wastewater pollution.

The density of the dinoflagellate Ceratium hirundinella was determined from May 1978 to May 1979 in 6 subarctic lakes located north of Great Slave Lake. The lakes ranged from 0.6 to 45 sq km in area and from 11 to 98 m in depth. They were classified into 4 trophic groups: oligotrophic, 2 degrees of mesotrophic, and eutrophic. The study lakes were situated in a forested region of the Precambrian shield. Kam Lake, highly eutrophic, received a continuous discharge of primary treated sewage throughout the study. Three other lakes (Long, Grace, Madeline) also received a small amount of domestic waste from cottages. Lakes Prosperous and Prelude were strongly oligotrophic. The seasonal patterns and vertical distribution of phytoplankton density varied widely among the lakes but were similar to those reported for temperate zone populations. The growing season was 4-8 months long. Both unimodal and bimodal growth curves were seen. Although the short summers limited the growing season to June-October, the timing of peak abundance (July, August, or September) was not influenced. Seasonal changes in C. hirundinella abundance were independent of the dynamics of other algal species. Optimum temperature for growth was 4 to 18°C. Late summer blooms were independent of temperature and were controlled by decreasing daylength after June. Nutrient availability con-

trolled the intensity, but not the timing, of abundance peaks. In the highly transparent lakes C. hirundinella grew in significant numbers at depths of 60-70 m because of high light penetration and oxygen levels. (Cassar-FRC)

W83-00052

#### AN INTEGRATED STUDY ON LITTORAL AND PELAGIC PRIMARY PRODUCTION IN A SOUTHERN AFRICAN COASTAL LAKE,

Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.

C. Howard-Williams, and B. R. Allanson. Archiv fur Hydrobiologie, Vol 92, No 4, p 507-534, November, 1981. 11 Fig, 3 Tab, 47 Ref.

Descriptors: \*Productivity, \*Phytoplankton, \*Aquatic plants, Lakes, Swartvlei Lake, \*South Africa, \*Meromictic lakes, Littoral zone, \*Primary production, Macrophytes, Potamogeton, Cladophora, Chara, Periphyton, \*Standing crops.

The primary production and standing crops of various components of the plant community in the pelagic and littoral zones of Swartvlei, a meromictic coastal lake at the southern tip of Africa, were investigated from 1975 to 1978. Annual mean production in mg C per sq m per day was 74.0 in the phytoplankton, 621 in the littoral algae, and 2493 in the macrophytes. On a whole lake basis these values (in g per sq m per a) were phytoplankton, 19; littoral algae, 29; and macrophytes 72. The littoral zone occupied 30% of the lake area and produced 86% of the autochthonous carbon; the phytoplankton, 14%. The net production and the percentage of total net production by the non-plankton plant communities were further divided as follows: Potamogeton, 72 g C per sq m per a, 52%; Chara, 19 g C per sq m per a, 14%; Phragmites/Scirpus, 17 g C per sq m per a, 12%; epiphytic algae, 5 g C per sq m per a, 4%; and adnate periphyton, 5 g C per sq m per a, 4%. The littoral zone is the center of almost all biological activity in the lake system in terms of the food web and energy flow and is the most sensitive to damage by human activity. (Cassar-FRC)

W83-00053

#### SOME ASPECTS OF THE COLONIZATION BY WATER MITES (ACARI, ACTINEDIDA) OF AN ARTIFICIAL SUBSTRATE IN A DISTURBED ENVIRONMENT,

Louvain Univ. (Belgium). Lab. of General and Experimental Ecology.

A. Dewez, and G. Wauthy.

Archiv fur Hydrobiologie, Vol 92, No 4, p 496-506, November, 1981. 2 Fig, 3 Tab, 16 Ref.

Descriptors: \*Wastewater pollution, \*Invertebrates, \*Self-purification, Water pollution effects, Mites, Acari, Actinedida, Rivers, Bryophytes, Species composition, Species diversity, Hygrobiates fluvialis, Bocq River, \*Belgium.

The water mite population was studied in the Bocq River, Belgium. The two main affluents of the Bocq, the Biron and the Leignon, are principally responsible for the pollution of the zone which has a gentle slope. The Leignon receives a large part of the sewage effluents of Ciney; the rest is drained by the Biron, which also carries the wastes from a slaughter house, dairy and cattle market. Since the natural bryophyte substrate had disappeared, pieces of sponge were installed in 6 stations in 3 zones as artificial substrate: oligosaprobic (A and B) upstream of outfalls; alpha-mesosaprobic (C and D) downstream of outfalls, and beta-mesosaprobic, (E and F). In March 1978 the total numbers of individuals were: A, 175; B, 100; and C to F, < 25 each. Total species numbers were: A, 9; B, 5; C, 2; D, 2; E, 6; and F, 3. There were also changes in the species distribution among the 3 zones. Self-purification was evident at station F, where some of the species present in the oligosaprobic zone were again observed. Apparently some of the water mites, especially several km in badly polluted water. (Cassar-FRC)

W83-00054

#### THE DEVELOPMENT OF ATTENUANCE DEPTH-PROFILING TO FOLLOW THE

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**CHANGING DISTRIBUTION OF PHYTOPLANKTON AND OTHER PARTICULATE MATERIAL IN A PRODUCTIVE ENGLISH LAKE**, Freshwater Biological Association, Ambleside (England).

J. F. Talling.

Archiv für Hydrobiologie, Vol 93, No 1, p 1-20, November, 1981. 10 Fig, 32 Ref.

Descriptors: \*Light penetration, Water depth, \*Phytoplankton, Attenuation, Lakes, Seasonal variation, Measuring instruments, Esthwaite Water, \*England, Iron compounds, \*Particulate matter, Stratification, Temperature, Water temperature, Dissolved oxygen, Oxygen, Ceratium, Dinoflagellates, Thermoclines, \*Vertical distribution, Thermal stratification.

A submersible beam transmissometer was adapted to record light attenuation directly against water depth. The apparatus was tested during summer stratification and autumn turnover (1975-77) in Esthwaite Water, England, where attenuation was related to the vertical distribution of particulate matter (phytoplankton and iron compounds). The device was simple and rapid in operation and produced good agreement in replicate profiles. Attenuation-depth profiles were related to temperature, dissolved oxygen, and the complex behavior of Ceratium hirundinella. This dinoflagellate avoids the surface in bright weather and accumulates above the oxycline. The apparatus was also used to produce a profile of horizontal variability over the lake, using 10 sampling stations. It revealed a dense population of Ceratium in the 0-6 m epilimnetic layer and an abundance of particulate ferric material at 7-12 m. (Cassar-FRC)

W83-00055

**GUIDELINES FOR SURFACE WATER QUALITY: VOL 1: INORGANIC CHEMICAL SUBSTANCES: COPPER**, Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.

For primary bibliographic entry see Field 5G. W83-00079

**THE TOXICOLOGY OF SILVER IODIDE IN RELATION TO ITS USE AS A CLOUD SEEDING AGENT**,

Department of Water Affairs, Pretoria (South Africa); Hydrological Research Inst., Pretoria (South Africa).

For primary bibliographic entry see Field 2B. W83-00084

**IN SITU RESPONSE OF PHYTOPLANKTON FLUORESCENCE TO RAPID VARIATIONS IN LIGHT**,

Institute of Ocean Sciences, Sidney (Australia). M. R. Abbott, P. J. Richerson, and T. M. Powell. Limnology and Oceanography, Vol 27, No 2, p 218-225, 1982. 5 Fig, 1 Tab, 30 Ref.

Descriptors: \*Phytoplankton, \*Fluorescence, \*Light intensity, Lakes, \*Lake Tahoe, \*California, \*Chlorophyll a, Inhibition, Limiting factors, Irradiation, Light penetration.

Fluorescence of phytoplankton chlorophyll a was measured in ultra-oligotrophic Lake Tahoe, California, at depths of 10, 35, and 60 m on June 13, 1980. Fluorescence yield was negatively correlated with surface irradiance at all depths. At 35 m the intensity of fluorescence change with light fluctuations was much stronger and the response of the phytoplankton to more rapid fluctuations in light was more apparent than at 10 and 60 m. Light conditions were near optimum at 35 m, light-inhibited at 10 m, and light-limited at 60 m. (Cassar-FRC)

W83-00141

**WATER QUALITY IN URBAN STREAMS—WHAT WE CAN EXPECT**,

North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.

A. M. Duda, D. R. Lenat, and D. L. Penrose.

Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1139-1147, July, 1982. 5 Fig, 4 Tab, 30 Ref.

Descriptors: \*Urban watersheds, \*Water quality standards, \*Monitoring, Water pollution effects, Water pollution sources, Wastewater pollution, Industrial wastewater, Asheville, \*North Carolina, Benthic fauna, Aquatic life, Macroinvertebrates, Invertebrates, Fish, Urban runoff, Streams, Sediments, Worms, Tubifex, Limnodrilus, Runoff.

Water quality in 2 urban streams, Nasty Branch and Sweeten Creek, in Asheville, North Carolina, was assessed by aquatic biological monitoring and analysis of water chemistry and sediments. An upstream forested watershed station served as a control. The water quality in the urban stream was very poor. Mean numbers of macroinvertebrates per sq m were 197 in the control, 564 in Sweeten and 73 and 204 at 2 Nasty Branch sites. Mean number of species per sq m were 35.3 in the control and 10.3, 8, and 4, at the 3 urban sites, respectively. The urban stations were dominated by worms (Tubifex tubifex and Limnodrilus) and midges (Chironomus and Cricotopus). The fish food organisms (mayflies, stoneflies, and caddisflies) had been virtually eliminated. No fish were present in the urban reaches. The composition of the macroinvertebrate population suggests that organic wastes and toxic substances were responsible for the poor quality of the water. Urban reaches contained much higher concentrations of BOD, COD, oil and grease, fecal coliforms, Al, Fe, and Mn, and somewhat higher levels of Cu, Pb, and Zn. In sediment samples Al, Cr, Cu, Fe, Mn, and Pb levels were elevated. In spite of the poor water quality only fecal coliform counts exceeded North Carolina water quality standards. Sources of pollution were the city motor pool and garage building, widespread and severe leaks in old sanitary sewer lines, and illicit industrial discharges. (Cassar-FRC)

W83-00144

**BIOASSAY TECHNIQUE FOR RELATIVE TOXICITY IN WATER POLLUTION CONTROL**,

Texas Univ. at Dallas.

For primary bibliographic entry see Field 5A. W83-00146

**DYNAMICS OF PHYTOPLANKTON IN FINNISH LAKES**,

Maj and Tor Nessling Foundation, Helsinki (Finland).

V. Ilmavirta.

Hydrobiologia, Vol 86, No 1/2, p 11-20, January, 1982. 8 Fig, 1 Tab, 40 Ref.

Descriptors: \*Phytoplankton, \*Population dynamics, \*Succession, Productivity, Humic acids, Lakes, \*Finland, Seasonal variation, Biomass, Nutrients, Limiting factors, Color, Light inhibition, Water temperature, Species composition, Phosphorus, Euphotic zone, Oligotrophic lakes, Shallow water, Brown water.

Overall dynamics of phytoplankton in Finnish lakes, particularly brown water lakes, are reviewed. Early studies concerned either (1) species composition and taxonomy or (2) production dynamics. More recent work has combined both approaches with profound results. Most Finnish lakes are ultraoligotrophic to slightly meso-oligotrophic. Poor production reflects the nutrient-poor soil and ancient acid bedrock. In humic lakes the euphotic layer is shallow, 3-4 m for water with colors of 50 mg Pt per liter or above. Summer productivity is not depressed during summer stratification, and therefore summer nutrient depletion is not apparent. Nutrients are rapidly recycled in the epilimnetic. Vertical migration, enabling efficient maximum production without inhibition by prolonged high light intensities, is a major factor in phytoplankton dynamics in many humic lakes. Although phosphorus is limiting to productivity, water temperature and solar radiation are more important factors. Phytoplankton adapt to the short growing season by continuous changes in species composition and pigment concentrations of algae. Seasonal successions of species are rapid and

distinct. For 3 lakes of different types (nutrient poor, mesohumic; eutrophic, mesohumic; and oligotrophic, very brown-water) seasonal succession and populations were very different. (Cassar-FRC)

W83-00153

**HEAVY METALS IN OYSTERS AND CLAMS OF ST. LOUIS BAY, MISSISSIPPI**,

Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.

T. F. Lytle, and J. S. Lytle.

Bulletin of Environmental Contamination and Toxicology, Vol 29, No 1, p 50-57, 1982. 4 Tab, 17 Ref.

Descriptors: \*Bioaccumulation, Metals, \*Clams, \*Oysters, \*Sediments, Sampling, Accumulation, Mollusks, Water pollution effects, Arsenic, Antimony, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Mercury, Molybdenum, Nickel, Selenium, Strontium, Titanium, Vanadium, Zinc, \*St. Louis Bay, \*Mississippi, \*Heavy metals.

A study to establish typical values for 17 metals in the water, sediment, and biota of St. Louis Bay before the operation of an ore refinery (T102) is described. Metals analyzed were: As, Sb, Be, Cd, Cr, Co, Cu, Fe, Pb, Hg, Mo, Ni, Se, Sr, Ti, V, and Zn. Oysters and clams were collected at two sites, water was collected at eight sites, and sediment was collected at the oyster-clam sites and 12 other sites. Only As, Cd, Cu, Se, Zn, Fe, and Hg occurred at detectable levels in oysters and clams. Metal behavior of clams and oysters was consistent with that observed in other bays throughout the Southeastern US. The oyster accumulated As to levels twice that accumulated by clams, while clams accumulated Se twice as efficiently as oysters. As and Se occurred at levels less than those found at similar locations, casting doubt on test results using dry tissue. (Small-FRC)

W83-00159

**WATER QUALITY STANDARDS AND WATER QUALITY**,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5G. W83-00162

**USE OF MATHEMATICAL MODELS TO PREDICT IMPACTS OF MINING ENERGY MINERALS ON THE HYDROLOGIC SYSTEM IN NORTHWESTERN COLORADO**,

TRW, Lakewood, Colorado, Energy Engineering Division.

For primary bibliographic entry see Field 4C. W83-00168

**WATER CHARACTERISTICS**,

Construction Engineering Research Lab. (Army), Champaign, IL.

For primary bibliographic entry see Field 5B. W83-00169

**THE AEROBIC MINERALIZATION OF AMINO ACIDS IN THE SALINE LAKE GREVELINGEN AND THE FRESHWATER HARINGVLIET BASIN (THE NETHERLANDS)**,

Delft Inst. for Hydrobiological Research, Yerseke (Netherlands).

A. B. J. Sperers.

Archiv für Hydrobiologie, Vol 92, No 1, p 114-129, August, 1981. 3 Fig, 7 Tab, 26 Ref.

Descriptors: \*Bacteria, \*Amino acids, \*Mineralization, Heterotrophic bacteria, Proteins, Haringvliet Basin, Lake Grevelingen, \*The Netherlands, Saline lakes, Eutrophic lakes, Oxygen uptake, Algae, Seasonal variation.

The bacterial uptake of various C14-labeled amino acids and of an algal protein hydrolysate, containing C14-labeled amino acids, was observed at 4 week intervals from September 1976 to September 1977 samples from saline Lake Grevelingen and eutrophic fresh water Haringvliet basin in the Netherlands. Seasonal variation of the uptake pa-

## Effects Of Pollution—Group 5C

parameters was comparable for all applied amino acids. The maximum uptake rate ( $V_{max}$ ) of algal protein hydrolysate by the heterotrophic bacteria in Lake Grevelingen varied from 0.43 to 23.38 ng C per liter per hour with peaks in March and summer. For Haringvliet  $V_{max}$  was 4 to 70 ng C per liter per hour with a peak in summer.  $V_{max}$  for aspartic acid uptake was slightly lower; for glycine and leucine, much lower. In Lake Grevelingen the respiration percentages were: protein hydrolysate, 31-54%; aspartic acid, 74-87%; in Haringvliet, protein hydrolysate, 58-72%; glycine, 50-74%; leucine, 13-35%; histidine, 52-73%; and aspartic acid, 69-88%. The calculated uptake capacity (or potential uptake) in g C per sq m per year for protein hydrolysate was 10.9 for Grevelingen and 18.7 for Haringvliet. The individual amino acids had lesser values. These were about 3% of the amount of mineralized carbon, as calculated from oxygen uptake experiments. Results suggest that measurement of the uptake of C14-labeled compounds represents a serious underestimation of the bacterial activity in situ. (Cassar-FRC) W83-00178

## EXCRETION AND DOC UTILIZATION BY OSCILLATORIA RUBESCENS D.C. AND ITS ACCOMPANYING MICRO-ORGANISMS, Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene.

T. P. Chang.  
Archiv fur Hydrobiologie, Vol 91, No 4, p 509-520, July, 1981. 7 Fig, 1 Tab, 26 Ref.

Descriptors: \*Eutrophic lakes, \*Dissolved organic matter, \*Cyanophyta, \*Excretion, Radioactive tracers, Organic carbon, Lakes, Alpine regions, Aquatic population, Microorganisms, Organic compounds, Carbon dioxide, Eutrophication.

Oscillatoria rubescens, which often causes water blooms in alpine lakes, can be made to produce extracellular organic substances, including a large proportion of mucilage through stimulation by some of its accompanying microorganisms. The co-relationship of various cyanophytes was examined using O. rubescens and two newly isolated *Synechococcus* species. Excretion and dissolved organic carbon (DOC) utilization were measured in time course using a radioactive carbon method. A 4-6% range of extracellular release was measured for these red-colored cyanophytes under three different patterns of excretion. Carbon dioxide was the main exudate component for these three species. Most DOC produced was of a low molecular weight, especially for O. rubescens. *Synechococcus* was able to utilize its own exudates along with some exudates from other sources. This feature allowed the *Synechococcus* species to outgrow O. rubescens both in culture and in nature, and offers a possible explanation for the recession of O. rubescens in alpine lakes. (Geiger-FRC) W83-00183

AN OVERVIEW OF ACID RAIN MONITORING ACTIVITIES IN NORTH AMERICA, Flow General, Inc., McLean, VA.  
J. Wisniewski, and J. D. Kinnaman.  
Bulletin of the American Meteorological Society, Vol 63, No 6, p 598-618, June, 1982. 3 Tab, 32 Ref.

Descriptors: \*Monitoring, \*Water pollution effects, \*Acid rain, \*Reviews, Ecological effects, Precipitation, Rainfall, Air pollution, Literature review, Environmental effects, Snow, Surveys, Fallout, \*North America.

Acid rain is known to acidify natural waters, resulting in damage to fish and other components of the aquatic ecosystem, degradation of drinking water supplies, deterioration of man-made structures, erosion of soils and damage to forests and crops. Acidic components may be deposited from the atmosphere by wet deposition (rain and snow), dry deposition (particles and gases), and special events (dews, frosts, and fogs). Most current monitoring activities focus on wet deposition or acid rain. Recent monitoring devices and 71 studies conducted or on-going in North America are surveyed. Tables are presented that describe the name or title of the study, the organization or agency

that funds each study, the chemical parameters monitored, the geographic extent and location of the study, the time period of operation, the types of samples used, where samples are analyzed, and a contact for further information. The Aerchem Metrics wet-dry collector is the most widely used instrument for collection of wet deposition and appears to be reliable in collecting precipitation samples for chemical analysis. Much of the wet deposition monitoring focuses on the between-year differences in precipitation acidity. No simple method for monitoring dry deposition is available on an experimental or commercial basis. The frequency of special events needs to be analyzed using existing climatological data. (Geiger-FRC) W83-00189

## STRUCTURAL CHARACTERIZATION OF AQUATIC HUMIC MATERIAL, North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.

W. Liao, R. F. Christman, J. D. Johnson, D. S. Millington, and J. R. Hass.  
Environmental Science and Technology, Vol 16, No 7, p 403-410, July, 1982. 4 Fig, 5 Tab, 25 Ref.

Descriptors: \*Humic acids, \*Chemical composition, \*Organic matter, Lakes, Fulvic acids, Lake Drummond, Virginia, Black Lake, North Carolina, Degradation, Organic compounds, Aromatic compounds, Aliphatic compounds.

Aquatic humic materials from Black Lake, North Carolina, and Lake Drummond, Virginia, were degraded with potassium permanganate oxidation and NaOH hydrolysis, then methylated. Gas chromatography/mass spectrometric analysis identified 76 compounds representing about 35% of the original total organic carbon prior to degradation. The fulvic acid and humic acid fractions of both samples produced degradation products qualitatively similar to each other, but some quantitative differences were observed. Results suggest that aquatic humic substances contain aromatic and aliphatic components. The aromatic rings contain 3-6 substituents (alkyl, carboxylic acids, ketones, or hydroxy groups). Polynuclear aromatic and fusing structures (furan and possibly pyridine) may also be present. The principal aliphatic segments are short saturated chains (2-4C) with some branched structures. The identified degradation products were classified as follows: 29 benzenecarboxylic acid methyl esters, 5 furancarboxylic acid methyl esters, 14 aliphatic monobasic acid methyl esters, 14 aliphatic dibasic acid methyl esters, 5 aliphatic tribasic acid methyl esters, and 8 carboxyphenyl glyoxylic acid methyl esters. The carbon dioxide which evolved was probably derived from carboxylic acids, phenols, quinones, and other structures. (Cassar-FRC) W83-00190

## IMPROVEMENTS IN QUANTIFYING THE PHOSPHORUS CONCENTRATION IN LAKE WATER, Alberta Univ., Edmonton. Dept. of Zoology.

E. E. Prepas.  
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 6, p 822-829, June, 1982. 2 Fig, 4 Tab, 29 Ref.

Descriptors: \*Particulate matter, \*Phosphorus, \*Sampling, Lakes, \*Bob Lake, \*Ontario, Oligotrophic lakes, Zooplankton, Variability, Water analysis, Pollutant identification, Stratification.

Phosphorus concentrations in oligotrophic Bob Lake, Ontario, were determined with smaller variance by dividing the total P pool into 2 fractions: dissolved and particulate matter smaller than 250 microns and particulate matter larger than 250 microns. Samples were collected at several stations and depths, the smaller fraction by water bottle, and the larger fraction by tow net. Digestion by potassium persulfate gave more repeatable results (average variance  $< 0.05$  mg P per cu m) than perchloric acid digestion at the low P concentration encountered, often less than 5 mg per cu m. During stratification a vertical P gradient in the smaller fraction was evident. P levels were lowest in the mixed large layer (4-6 mg per cu m), slightly

less in the hypolimnia, with a maximum in the metalimnia (6-8 mg per cu m). There were small but significant differences in P levels of the smaller fraction at stations less than 1 km apart. Of the total P (smaller plus larger fractions), 13-28% was contained in the larger fraction in the epilimnia. The percentage of total P decreased with depth, 4-12% in the metalimnia,  $< 1-3\%$  in the hypolimnia. Thus the larger particle fraction was concentrated in the epilimnia and the dissolved and smaller P-containing matter, in the metalimnia. Removing the larger fraction (containing a few zooplankton with highly variable amounts of P) reduced the average variance associated with the mean P from 1.0 to 0.024 mg per cu m. (Cassar-FRC) W83-00208

HEAVY METAL INTERACTIONS AND DYNAMICS IN SIMULATED NAUGATUCK RIVER MICROCOEMS, Connecticut Univ., Storrs. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5B. W83-00214

## RE-EVALUATION OF THE EFFECTS OF DEICING SALT RUNOFF ON A SMALL URBAN LAKE, Michigan Univ., East Lansing. Dept. of Zoology.

J. H. Judd, and J. W. Steggall.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108332, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, March 1982. 18 p, 3 Fig, 4 Tab, 14 Ref, 1 Append. OWRT A-114-MICH(1).

Descriptors: \*Water analysis, \*Lake morphology, \*Urban runoff, \*Highway icing, \*Saline water intrusion, \*Snowmelt, Chlorides, Deicers, Salt runoff, Water pollution, Water pollution control, Water quality, Water quality control, Nitrates, Saline water, Urban watersheds, Saline-freshwater interfaces.

Water samples were taken at a point near the lake center at 1-meter intervals from the surface to the bottom and from two primary inlets biweekly from January to October, 1981. Analyses were made for temperature, oxygen, conductivity, pH, alkalinity, chloride, and total phosphates, nitrates and total dissolved solids. While the amount of road salt entering from the lake subdivision was greatly reduced due to lowered use, the lake still receives an appreciable amount of salt runoff each winter. The major inflow is now from the highways north of the lake. Since the movement of saline water is through a small wetland before entering the lake, a more diffuse runoff occurs, apparently facilitating mixing of the saline water throughout the water column, thereby not greatly increasing stability of stratification. Hence, the lake can mix completely in the spring. The lake remains highly eutrophic; total phosphates are high throughout the year, while nitrate levels are greatly reduced. During the summer, nitrates were virtually undetectable. It may be that nitrates have become the limiting factor in the lake. During most of the 1981 winter, chloride concentrations were 150 mg/liter or less, except for one day in February when concentrations at one outflow reached 1250 mg/liter. Two weeks following, chloride in the bottom meter of water had increased from 96 to 720 mg/liter and the conductivity from 440 to 1000 micro-mhos. (Zielinski-MAXIMA) W83-00227

## ANOXIC NUTRIENT REGENERATION AND THE EUTROPHICATION OF ESTUARINE WATERS, Rhode Island Univ., Kingston. School of Oceanography.

S. W. Nixon, and P. F. Roques.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108027, Price codes: A06 in paper copy, A01 in microfiche. Final Report, 1981. 110 p, 18 Fig, 4 Tab, 98 Ref, 8 Append. OWRT B-082-R1(1).

Descriptors: \*Eutrophication, \*Estuarine environment, \*Oxidation process, \*Nutrients, \*Water anal-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

ysis, \*Pettquamscutt River estuary, Estuaries, Oxygen balance, Oxygen depletion, Organic compounds, Bottom sampling, Sediment-water interfaces, Phosphorus, Nitrogen, Silicon, Carbon, \*Rhode Island.

The rates and stoichiometry of nutrient regeneration from sedimenting organic matter were investigated in the Pettquamscutt River estuary under anoxic and oxic conditions. This estuary exhibits high organic matter sedimentation and reduced water circulation. It was observed that oxygen consumption in the water and sediments exceeds renewal processes and anoxic conditions develop. The stoichiometry of nutrient concentrations in the anoxic bottom water (carbon/sulfur/nitrogen/phosphorus/silicon ratio of 108.59:4.14:3.0:3.43) indicates that the nitrogen and phosphorus regenerated is greater than expected from anoxic zone sediment trap material (carbon/nitrogen/phosphorus ratio of 140: 14:1). Organic matter oxidation rates and nutrient regeneration stoichiometry were directed measured by using chambers placed over the sediment and monitoring concentration changes in the isolated bottom water. The rate determined for carbon oxidation based on sulfide release (14.8 millimoles carbon/sq m/day) was found to be equal to that in nearby oxygenated sediments, and about half the rate observed in Narragansett Bay sediments at the same temperature (11 degrees). The elemental nitrogen/phosphorus ratio released was similar to the observed ratio of these metabolic products accumulating in the anoxic bottom waters. These data permit testing of recent models for organic decomposition under anoxic conditions. (Zielinski-MAXIMA) W83-00263

**THE EFFECTS OF EXCESSIVE NITROGEN AND PHOSPHORUS IN SURFACE WATERS OF A PRAIRIE MARSH,**  
Iowa State Univ., Ames. Dept. of Botany.  
For primary bibliographic entry see Field 5G.  
W83-00266

**A PRELIMINARY STUDY OF NATURAL AQUIFER DISCHARGE OF GUAM,**  
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.  
For primary bibliographic entry see Field 5B.  
W83-00271

**THE OCCURRENCE OF A FUNGAL PARASITE ON A TETRASELIMIS (PRASINOPHYCEAE) SPECIES,**  
Rand Afrikaans Univ., Johannesburg (South Africa). Dept. of Botany.  
J. Pretorius and A. H. Engelbrecht.  
Water SA, Vol 6, No 4, p 181-185, October, 1980.  
12 Fig, 10 Ref.

Descriptors: \*Eutrophication, \*Algal growth, \*Aquatic fungi, \*Parasitism, \*Pathogenic fungi, Algae, Aquatic life, Aquatic plants, Marine algae, Parasites, Morphology, Infection, Electron microscopy, Water quality, Diseases, Pathology, Plant pathology, South Africa, Vaal River Barrage.

Algal blooms develop annually from August to early September in the lower parts of the freshwater Vaal River Barrage, usually lasting for 2-3 weeks; microscopic studies of the algae in the dying-off stage of the bloom had shown that most of them were parasitized by a chytridial type of parasite. The occurrence of this type of parasite on a Tetraselmin species, the algae almost exclusively responsible for the blooms, was examined. The main ultrastructural features in identifying the alga (e.g., the scales and hairs on the four flagella; the situation of the four flagella) are described. The infection of the algal host cells by the parasites, their reactions, and the final ultra-structural collapse of the cells, are reported and illustrated. The structure of this fungal parasite of Tetraselmin corresponds with that of the Chytridium reported previously, especially to the structure of the encysted zoospores and the penetration and structure of the haustorium. The role of the parasite in controlling Tetraselmin bloom could not be assessed. However, considering that the parasitizing

of the host cells invariably leads to destruction of the host protoplasm and cell death, it is accepted that the parasite does play a role in limiting the bloom of Tetraselmin. Cytological study was made through the use of electron microscopy. (Zielinski-MAXIMA) W83-00288

**PERSISTENCE IN MODEL ECOSYSTEMS,**  
Georgia Univ., Athens. Dept. of Mathematics.  
For primary bibliographic entry see Field 5B.  
W83-00294

**POLYNUCLEAR AROMATIC HYDROCARBONS AND CELLULAR PROLIFERATIVE DISORDERS IN BIVALE MOLLUSCS FROM OREGON ESTUARIES,**  
Environmental Research Lab., Gulf Breeze, FL. M. C. Mix.

Available from the National Technical Information Service, Springfield, VA 22161 as PB82-189523, Price codes, A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-82-026, May 1982. 5 p.

Descriptors: \*Clams, \*Oysters, \*Mussels, \*Polynuclear aromatic hydrocarbons, \*Water pollution effects, \*Carcinogens, Mollusks, Estuaries, Monitoring, Shellfish, Solubility, \*Oregon.

Indigenous populations of economically-important bivalve molluscs were used as monitors for detecting and quantifying 15 environmental polynuclear aromatic hydrocarbons (PNAH), including 11 compounds classified as carcinogens, 11 EPA Priority Pollutants, and 11 Toxic Pollutants. Baseline levels of PNAH were determined during a two-year for mussels, clams and oysters from different sites in Yaquina, Coos, and Tillamook Bays, Oregon. Total concentrations of the 15 substituted PNAH were 30 to 60 micro g/kg in shellfish from uncontaminated waters to greater than 1000 micro g/kg in those from sites classified as contaminated. A major effort was made to determine and evaluate relationships between PNAH and their concentrations in shellfish. Multiple regression and multiple correlation techniques were used to identify and evaluate interrelationships between PNAH. A significant potential exists for developing predictive models for PNAH in aqueous environments and their concentrations in bivalve molluscs. Statistical analyses also indicated that concentrations of individual PNAH were greater for the isomer which had the greatest solubility in water. Cellular proliferative disorders resembling neoplastic conditions in vertebrates were found in mussels with the greatest PNAH concentrations. (Moore-SRC) W83-00295

**BACTERIOPLANKTON AFFECTED BY PHOSPHORUS PRECIPITATION TREATMENT IN A POLYTROPHIC LAKE,**  
Bayerisches Landesamt fuer Wasserwirtschaft, Muenchen (Germany, F.R.).  
For primary bibliographic entry see Field 5G.  
W83-00315

**PALEOLIMNOLOGY OF LAKE ISLE, ALBERTA, CANADA (INCLUDING SEDIMENT CHEMISTRY, PIGMENTS AND DIATOM STRATIGRAPHY),**  
Alberta Univ., Edmonton. Dept. of Botany.  
For primary bibliographic entry see Field 2H.  
W83-00316

**POLYCYCLIC AROMATIC HYDROCARBONS IN SEWAGE, MUSSELS AND TAP WATER,**  
Central Inst. for Industrial Research, Oslo (Norway).  
For primary bibliographic entry see Field 5B.  
W83-00330

**ACIDIC PRECIPITATION AND ITS CONSEQUENCES FOR AQUATIC ECOSYSTEMS: A REVIEW,**  
Columbia National Fishery Research Lab., MD. T. A. Haines.

*Transactions of the American Fisheries Society, Vol 110, No 6, p 669-707, November, 1981. 4 Fig, 3 Tab, 330 Ref.*

Descriptors: \*Air pollution effects, \*Acid rain, \*Aquatic habitats, \*Hydrogen ion concentration, \*Aerosols, Nitric acid, Sulfuric acid, Organic compounds, Metals, Water pollution, Fish, Algae, Macrophytes, Invertebrates, Environmental effects, Pollution effects, \*Literature review.

Current understanding of the acid rain phenomenon, adverse effects of acid rain on aquatic ecosystems, and solutions to the problem are discussed. Increases in sulfuric and nitric acid aerosols have produced highly acidic precipitation which has affected surface waters. Contaminated waters have decreased alkalinity and pH and increased metals and organic compounds. Fish, decomposers, algae, macrophytes, and invertebrates have been affected primarily by hydrogen ion concentration changes but also by acid stress. Reduction of sulfur and nitrogen oxides, reduction of water acidity, and the breeding of resistant species are possible solutions. (Small-FRC) W83-00331

**THE FATE OF 2,4,6-TRICHLOROPHENOL IN AN AQUATIC CONTINUOUS-FLOW SYSTEM,**  
Jyvaskyla Univ. (Finland). Dept. of Cell Biology.  
For primary bibliographic entry see Field 5B.  
W83-00332

**THE RELATIONSHIP BETWEEN NUTRIENT STATUS AND CHEMICAL COMPOSITION OF PERIDINIUM CINCTUM DURING THE BLOOM IN LAKE KINNERET,**  
Israel Oceanographic and Limnological Research Ltd., Tiberial; and Kinneret Limnology Lab., Tiberial (Israel).  
D. Wynne, N. J. Patni, S. Aaronson, and T. Bernan.  
Journal of Plankton Research, Vol 4, No 1, p 125-136, 1982. 4 Fig, 3 Tab, 45 Ref.

Descriptors: \*Peridinium, \*Lakes, \*Nutrient requirements, \*Eutrophication, Dinoflagellates, Nutrients, Limiting nutrients, Carbon, Nitrogen, Chlorophyll, Phosphorus, Proteins, Carbohydrates, Lipids, Water temperature, Hydrogen ion concentration, Irradiation, \*Lake Kinneret, \*Israel.

The major cellular chemical components of Peridinium cinctum were analyzed to determine possible relationships between growth cycle parameters and nutrient sufficiency or deficiency. Decline of the Lake Kinneret bloom was not associated with physical or chemical parameters of the water. Average cell content was 48 for carbon, 4 for nitrogen, and .09% for chlorophyll (dry weight) for the growth season. Cell phosphorus dropped initially but then remained stable. During the bloom, protein showed no definite trend, but carbohydrate and lipid content decreased and nucleic acid increased. Thus, nutrient status did not limit Peridinium growth. Rapid decline of Peridinium in June is probably brought about by physical and chemical factors such as pH, temperature, and irradiation. (Small-FRC) W83-00333

**THE ECOLOGICAL EFFECTS OF 2-METHYLTHIOTRIAZINE HERBICIDES USED FOR AQUATIC WEED CONTROL IN NAVIGABLE CANALS, II. EFFECTS ON MACROINVERTEBRATE FAUNA, AND GENERAL DISCUSSION,**  
Liverpool Univ. (England) Dept. of Botany.  
R. G. Hanbury, K. J. Murphy, and J. W. Eaton.  
Archiv fur Hydrobiologie, Vol 91, No 4, p 408-426, July, 1981. 4 Fig, 1 Tab, 33 Ref.

Descriptors: \*Water pollution effects, \*Macroinvertebrates, \*Submerged plants, \*Aquatic weed control, \*Herbicides, \*Terbutryn, Macrophytes, Aquatic populations, Aquatic plants, Pesticides, Species diversity, Navigation canals, Canals, Cyanophytes.

Macroinvertebrate fauna associated with aquatic macrophytes were studied in canals which had

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

been treated for weed control with suboptimal levels of terbutryne two years previously. Differences from untreated control canals were in most cases attributed to local variations in flora caused by factors other than herbicide treatment. Nevertheless, a site treated with terbutryne and cyantran in successive years was species deficient, both one and two years after herbicide applications. Loss of invertebrate taxa associated with the submerged macrophytes was an invariable feature, except where herbicide residue levels were ineffectively low. This effect was especially noticeable where residues were high and macrophyte destruction was most pronounced. Loss of invertebrate groups associated with the plants was compensated for by an increase in the abundance of benthic fauna, especially Nematoda and Lumbricidae. However, at another site, filamentous algae which survived a less stringent herbicide treatment appeared to act as a refuge for the remaining macrophyte fauna, which recovered in parallel with the submerged flora by the following spring. (Geiger-FRC)  
W83-00343

### 5D. Waste Treatment Processes

**TRADE EFFLUENT CONTROL AND THE MICROPROCESSOR,**  
Anglian Water Authority (England). Lincoln Sewage Div.  
For primary bibliographic entry see Field 5G.  
W83-00003

### INVESTIGATIONS ON CELLULOSE BIODEGRADATION IN ACTIVATED SLUDGE PLANTS,

Louvain Univ. (Belgium). Lab. of Industrial Microbiology and Biochemistry.  
H. Verachtert, K. Ramasamy, M. Meyers, and J. Bevers.  
Journal of Applied Bacteriology, Vol 52, No 2, p 185-190, 1982. 1 Fig, 4 Tab, 21 Ref.

Descriptors: \*Biodegradation, \*Wastewater treatments, \*Anaerobic digestion, \*Cellulose, Activated sludge, Municipal wastewater, Degradation, Microbial degradation, Bacteria, Actinomycetes, Fungi, Microorganisms, Aerobic digestion, Sludge digestion, Organic compounds, Suspended solids.

The biodegradation of cellulose in activated sludge was studied. Cellulose is the major carbon substrate entering municipal wastewater treatment plants. Cellulolytic microorganisms were isolated and enumerated in different treatment plants. In a study over a period of about 1 year, cellulolytic microbes were evaluated after different water treatment steps. The degradation of cellulose in nylon bags suspended in the activated sludge tank was examined, and the activities of cellulase components were assayed. The amounts of cellulose and lignin in the suspended solids arising from different treatment steps were also determined. Results indicated that active breakdown of cellulose occurred in the activated sludge. The biodegradation was mostly bacterial. Although no significant bacteria enrichment was found in the sludge floc, cellulase activity was increased. Nylon bag studies suggested that about 60% (wt/wt) of the cellulose entering the system could be degraded by bacteria during aerobic treatment, while 50-60% of the cellulose in the surplus activated sludge was broken down during anaerobic digestion. (Geiger-FRC)  
W83-00013

**CORRELATION OF ROTIFER ASSOCIATIONS IN A CHAIN OF LAKES FED BY RECLAIMED SEWAGE,**  
Concordia Univ., Montreal (Quebec).  
For primary bibliographic entry see Field 5G.  
W83-00023

**TEXTILE INDUSTRY WASTEWATER TREATMENT BY AIR FLOTATION,**  
Department of the Environment, Ottawa (Ontario).

Report No. EPS-4-WP-79-6E, April, 1981. 61 p, 12 Fig, 17 Tab, 3 Append.

Descriptors: \*Wastewater treatment, \*Flotation, \*Textile mill wastes, \*Industrial wastewater, Water quality control, Coagulation, Flocculation, Textiles, Industrial wastes, Bleaching wastes, Industrial plants, Wastewater, Industrial water, Effluents, Water quality, Wastewater facilities, Wastewater disposal, Primary wastewater treatment, \*Air flotation.

A pilot-scale study was initiated to demonstrate that textile industry wastewater could be reused after coagulation-flocculation and air flotation treatment. It was determined that this process offers great promise for recycle of some of the treated wastewaters, and could become an important energy conservation factor. Attempts to treat some specific process effluents, however, were unsuccessful. Tests were carried out at three different plants in Quebec province. The results were assessed by laboratory analyses and by limited recycling tests. Following 15 weeks of testing, it was concluded that air flotation is an excellent preliminary treatment, except in the case of very special effluents. Alum was the best coagulant for obtaining a clear colorless effluent. Most effluents treated contained a very significant amount of heat energy. For recycling, the three most promising textile effluents came from carpet dyeing. However, it was not possible to draw any conclusions for effluents from lot dyeing of polyester. Effluents from the Millitron, Kuster, and latex coating processes cannot be treated by air flotation. The results justify the recommendation that a full-scale air flotation unit for textile processing wastewater treatment be built. (Zielinski-MAXIMA)  
W83-00080

**STORMWATER RUNOFF TREATMENT BY IMPOUNDMENT: BARRHAVEN PILOT STUDY,**  
Ottawa-Carleton Regional Municipality (Ontario). Works Dept.  
R. J. Gieta.  
Report SCAT-8, 1981. 72 p, 36 Fig, 12 Tab, 8 Ref, 2 Append.

Descriptors: \*Storm water, \*Storm wastewater, \*Storm runoff, \*Rainfall-runoff relationships, \*Wastewater treatment, Runoff, Impoundments, Storm-overflow sewers, Runoff coefficient, Runoff volume, Rainfall, Suspended solids, Bacteria, Nutrient removal, Runoff rates, Mathematical studies, Water treatment.

A 2-year study was conducted on stormwater runoff treatment by impoundment in an open basin, with the treatment system operated as a batch process for one summer and as a continuously-overflowing pond for another. Impoundment reduced pollutant loadings by over 90% for suspended solids, 75-90% for bacteria (total and fecal coliforms, and fecal streptococcus), and 25-50% for organic nitrogen and total phosphorus compounds when the runoff could be stored for over 12 hours. At least 5 mm of rainfall were needed to produce measurable runoff. Runoff/runoff ratios estimated the runoff volumes that would be generated by up to 25-year return frequency storms of 1- and 2-hour durations. From this, a storage volume of 40,000-47,000 cu m was indicated, on the basis of runoff containment from a 10-year storm. The most effective treatment system operating method was to keep the reservoir drawn down to a shallow pond. When runoff entered the pond, the drain valve was closed and the treatment system filled. If possible, runoff volume was contained until its quality was suitable for discharge. When effluent quality became satisfactory, the reservoir was drained to the original shallow pond and dry weather flow allowed to pass through. Allowing one day to fill and one day for storage, the reservoir should require two days to empty. (Zielinski-MAXIMA)  
W83-00083

**THE CHARACTERIZATION AND PROCESSING OF LIME SLUDGES FROM WATER RECLAMATION PLANTS,**

National Inst. for Water Research, Pretoria (South Africa).

M. Ronen.  
CSIR Research Report WAT 55, 1978. 234 p, 172 Fig, 48 Tab, 159 Ref, 3 Append.

Descriptors: \*Lime, \*Sludge, \*Reclaimed water, \*Sludge drying, \*Particle size, Water treatment, Sludge disposal, Dewatering, Organic matter, Particulate matter, Sludge volume index, Wastewater facilities, Waste disposal, Sludge conditioning, Sludge solids, Sludge thickening.

Sludges derived from lime treatment in water reclamation plants were characterized for their composition and their particulate, settling, dewatering, rheological, and recalcination properties. Sludge treatability was found to be controlled by particle properties, which are, in turn, determined by the lime treatment conditions. The effect of these conditions on the sludge properties was examined. The sludges were produced by lime treatment of sewage or secondary effluent. The scope of work comprised full-scale, pilot plant scale, and laboratory studies. It was found that the lime sludges represent a heterogeneous particulate mixture having both discrete particles and flocculent voluminous particulate matter. Sludge particles tend to agglomerate and show a compressible behavior. Sludges with different characteristics are produced from different lime treatment conditions. The presence of high magnesium in the influent causes deterioration in lime sludge dewaterability, causing overall resistance to filtration. Colloidal organic matter from sewage in the primary sludge also causes poor dewaterability, while large discrete particles in sludges from reclaimed lime use makes sludge dewatering easier. When sludges are produced with iron use, they possess thixotropic properties which can be described by a model. Reclaimed lime can be beneficiated on a particle size basis, containing 77-80% calcium oxide. (Zielinski-MAXIMA)  
W83-00086

### SIMPLE CONTROL TESTS FOR OPERATORS OF SMALL WASTEWATER TREATMENT PLANTS,

National Inst. for Water Research, Pretoria (South Africa).

R. J. L. C. Drews.

CSIR Technical Guide K51, 1980. 23 p, 1 Fig, 5 Tab, 1 Append.

Descriptors: \*Wastewater treatment, \*Testing procedures, \*Water quality control, Wastewater facilities, \*Water analysis, Field tests, Water quality, Test facilities, Water treatment facilities, Chemical analysis, Activated sludge process, Biofiltration, Stabilization ponds, Water quality standards, Physical properties, Physicochemical properties, Sludge digestion.

Instructions are provided covering simple test methods for the characterization of influent and effluent quality for use by small wastewater treatment plant operators. The described tests require only a minimum of laboratory space, no background of analytical chemical skills, little manipulative skill, and can be learned quickly. Instructions are given on sampling procedures, on physical characterizations (temperature, pH, flow, turbidity measurements), on sludge characterizations (settling solids, settled volume, suspended solids, sludge volume index), and for influent and effluent quality (suspended solids, relative stability, ammonia nitrogen (NO<sub>2</sub>), nitrite-N, nitrate-N, phosphate, and free and total chlorine). The nitrogen, phosphorus, and chlorine tests are performed using test kits. Each test method is followed by an explanation of how to interpret the results obtained. Guidance is also provided for the reporting of results, illustrated by examples in tabular and graphic formats. A listing of recommended tests is given relative to sampling points where they may be best applied for activated sludge plants, biofilter plants, and stabilization ponds. (Zielinski-MAXIMA)  
W83-00092

**THE USE OF OXYGEN TO UP RATE THE TREATMENT CAPACITY OF A CONVEN-**

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

#### TIONAL SURFACE-AERATION PLANT AT HOLDENHURST (BOURNEMOUTH) SEWAGE TREATMENT WORKS,

Wessex Water Authority, Bristol (England). Avon and Dorset Recovery Div.  
M. Robinson, R. A. Varley, and A. R. Kimber.  
Water Pollution Control, Vol 81, No 3, p 391-398, 1982. 7 Tab, 2 Ref.

Descriptors: \*Oxygenation, \*Aeration, \*Activated sludge process, \*Wastewater treatment, Vitox oxygen units, Nitritation.

Vitox oxygen units were installed at the Holdenhurst, England sewage treatment works because the plant's effluent did not meet BOD standards even at less than design flows. Oxygen injection is regulated for carbonaceous oxidation only. The effluent is pumped to four nitrifying biological filters before discharge into the River Stour. Operation of the units is controlled by dissolved oxygen monitoring, either with continuous pumping and periodic oxygen injection or with both pump and oxygen under dissolved oxygen monitoring control. The operations of both subunits are described in detail. (Cassar-FRC)  
W83-00133

#### A SIMULATION STUDY ON THE OPERATION OF LABORATORY SCALE ANAEROBIC DIGESTERS,

Cape Town Univ. (South Africa). Dept. of Chemical Engineering.  
G. S. Hansford.

Water SA, Vol 8, No 2, p 69-73, April, 1982. 9 Fig, 1 Tab, 4 Ref.

Descriptors: \*Anaerobic digestion, \*Sludge digestion, \*Kinetics, \*Wastewater treatment, Simulation analysis, Biological treatment, Digestion.

Simulation analysis and experimental runs of laboratory anaerobic digesters at constant sludge age and constant sludge concentration were used to determine kinetic parameters. At constant sludge age the system's response to changes in operating conditions was very slow, 3-5 times the sludge age, making experimental studies impractical. However, under constant sludge concentration conditions the response time was much shorter, on the order of the hydraulic residence time. Simulation analysis showed that a step change in feed rate from 20,000 to 30,000 mg COD per liter in a reactor operated at constant sludge concentration of 14,600 mg per liter and hydraulic residence time of 2 days attained a new steady state within 1.1 days. The reactor, operated at constant sludge age of 30 days, required 300 days to reach a new steady state. The 99% levels of recovery were 0.32 and 145 days for the constant concentration and constant age runs, respectively. For a 4 day hydraulic retention time the recovery of the steady state took 2.1 and 300 days, respectively. The microbial systems used in the simulation obeyed a simple Monod kinetic model. Conclusions drawn from this study may not apply to systems subjected to inhibition from toxic materials. (Cassar-FRC)  
W83-00138

#### HIGH-QUALITY TRICKLING FILTER EFFLUENT WITHOUT TERTIARY TREATMENT,

Brown and Caldwell, Eugene, OR.  
D. P. Norris, D. S. Parker, M. L. Daniels, and E. L. Owens.

Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1087-1098, July, 1982. 8 Fig, 4 Tab, 5 Ref.

Descriptors: \*Trickling filters, \*Clarifiers, \*Solids contact processes, Aeration, Flocculation, Biological wastewater treatment, Sedimentation, Sludge, \*Advanced wastewater treatment, \*Secondary wastewater treatment.

A secondary sedimentation process in a Corvallis, Oregon, trickling filter plant was modified to achieve both secondary treatment (monthly BOD<sub>5</sub> and suspended solids average of < 30 mg per liter) and advanced wastewater treatment (monthly BOD<sub>5</sub> and suspended solids average of < 10 mg per liter). The new process, named trickling filter/

solids contact process, used solids contact clarifiers for enhanced suspended solids removal from trickling filter effluent. Sludge was recirculated to an aerated channel after the trickling filter and ahead of the clarifier to maintain the flocculating properties of the recycled solids. Here a significant amount of BOD was also removed. The secondary sedimentation tanks had center wells with gently stirring mechanical flocculators. No chemicals were added in the flocculation process. This system produced a monthly average of 10 mg per liter BOD and suspended solids at filter loading rates of 561 g per cu m per day. Optimum liquor solids concentration was 500-1500 mg per liter. The secondary sludge produced was exceptionally dense and fast-settling. Sludge yields were comparable to those found in the conventional activated sludge process. (Cassar-FRC)  
W83-00142

#### BIOXIDATION OF PAINT PROCESS WASTEWATER,

Ford Motor Co., Dearborn, MI. Chemistry Dept.  
J. A. Brown, Jr., and M. Weintraub.  
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1127-1130, July, 1982. 5 Fig, 1 Tab, 7 Ref.

Descriptors: \*Bioxidation, \*Industrial wastewater, \*Solvents, \*Paint industry, Biodegradation, Degradation, \*Wastewater treatment, Activated sludge process, Cellosolve, \*Oxidation.

A paint process wastewater effluent (COD 900-1000 mg per liter) and a simulated paint wastewater containing cellosolve (COD 500 mg per liter) were treated in a modified laboratory scale continuous-flow completely mixed aerated activated sludge reactor. Cellosolve (2-ethoxy ethanol) comprised about 47% of the identified organic material in the paint process wastewater. The coefficient of substrate removal at an average mixed liquor volatile suspended solids concentration of 3200 mg per liter was 0.00012 liters per mg per 20 hour workday for cellosolve and 0.00017 liter per mg per 20 hour workday for the paint process wastewater. Cellosolve biodegradation, 39% at 1.2 days' residence time, increased to 87% at 2.4 days' residence time. The paint wastewater biodegradation increased from 40% at 0.4 day's residence time to more than 80% at 1 day's residence time. Gas chromatographic analysis of the cellosolve effluent showed that 100% of the cellosolve was degraded in 2.4 days, but only 87% of the COD. This suggests that cellosolve degradation products were not biodegraded at the same rate or by the same metabolic pathway as seen in cellosolve degradation. (Cassar-FRC)  
W83-00143

#### RECYCLING OF MERCURY AND SILVER FROM COD TESTS,

Wayne County Dept. of Public Works, Wyandotte, MI.

S. Aslam, and O. L. Walker.  
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1148-1151, July, 1982. 5 Tab, 5 Ref.

Descriptors: \*Chemical oxygen demand, \*Silver, \*Mercury, \*Wastewater treatment, Pollutant identification, Metals, Heavy metals, Reclamation, \*Recycling, \*By-product recovery.

Mercury and silver were recovered from COD testing solution. NaCl was added to the waste solution to precipitate AgCl. The precipitate was washed with warm dilute sulfuric acid and distilled water to remove traces of impurities, dried, and stored for later recovery of metallic Ag. The filtrate, containing Hg, was treated with FeS to precipitate HgS. The AgCl was reduced to the metallic state, 99.9% pure, using powdered Zn and dilute sulfuric acid. The COD reagent, Ag<sub>2</sub>SO<sub>4</sub>, was prepared by adding nitric acid and sulfuric acid to the metallic Ag. HgS was converted into the reagent mercuric dioxysulfate by HCl addition to form HgCl<sub>2</sub>. Addition of NaOH, followed by dilute sulfuric acid, formed the lemon yellow precipitate mercuric dioxysulfate, Hg(HgO<sub>2</sub>SO<sub>4</sub>). This new method removed 98.0% of Hg, whereas the

EPA recommended method removed 96.4%. COD was determined in 20 samples containing 38-1272 mg per liter COD using reclaimed reagents and the standard procedure. There was no significant difference between results in the 2 groups. Recycling of Ag and Hg can reduce costs of the COD test by 60-70%. (Cassar-FRC)  
W83-00145

#### MANAGEMENT AND CONTROL TECHNOLOGY FOR URBAN STORMWATER POLLUTION,

Santa Clara Univ., CA. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W83-00148

#### ADENOSINE TRIPHOSPHATE AS A CONTROL PARAMETER FOR ACTIVATED SLUDGE PROCESSES,

Philip M. Botch and Associates, Bellevue, WA.  
P. C. Roe, Jr., and S. K. Bhagat.  
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 244-254, March, 1982. 12 Fig, 2 Tab, 29 Ref.

Descriptors: \*Activated sludge process, \*Adenosine triphosphate, \*Process control, Performance evaluation, Biomass, Kinetics, Settleable solids, Suspended solids, \*Wastewater treatment.

Effective activated sludge process treatment of municipal and industrial wastewaters depends on control of the kinetic and settling properties of the sludge, which in turn relies on maintenance of proper biomass levels. Previous studies have shown that adenosine triphosphate (ATP) is a good parameter for studying the viable biomass content of activated sludge, provided that shocks and environmental stresses are minimized. The use of ATP as a measure of the viable biomass concentration in analyzing the biokinetic and settling properties of activated sludge was investigated. Using ATP as a measure of living biomass and suspended solids as a measure of total biomass, the viability of the culture was found to be directly proportional to the ratio of ATP to suspended solids. The viability was shown to be a function of the net specific generation rate of the nonviable biomass, and the net growth rate of the viable biomass was shown to be directly related to the substrate removal rate of the living organisms. Evaluation of the kinetic coefficients showed that the death rate of viable organisms and the decay rate of nonviable biomass were high. The sludge settling characteristics were shown to be functions of the mean cell residence time and the ATP to suspended solids ratio. The sludge volume index was very high at a low mean cell residence time and high ATP to suspended solids ratio, but dropped rapidly and stabilized as the sludge aged and the viability decreased. It is concluded that ATP is a good indicator of the biokinetic and settling characteristics of activated sludge under laboratory steady-state conditions. However, further research is needed to determine the applicability of ATP under nonsteady-state conditions and to understand the mechanism of solid/liquid separation. (Carroll-FRC)  
W83-00149

#### IMPROVEMENTS IN FOAM FLOTATION FOR LEAD REMOVAL,

IBM Corp., Houston, TX.  
M. A. Slapik, E. L. Thackston, and D. J. Wilson.  
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 238-243, March, 1982. 3 Fig, 2 Tab, 8 Ref.

Descriptors: \*Fotation, \*Foam separation, \*Wastewater treatment, \*Lead, Heavy metals, Colloids, Cost analysis, Pilot plants, Industrial wastewater.

Current regulations mandate that the concentration of lead in industrial effluents be less than 0.10 milligrams per liter. These wastewaters can be treated by chemical precipitation, ion exchange, carbon adsorption, reverse osmosis, or electrodeionization. However, each of these methods has drawbacks. Adsorbing colloid foam flotation has been shown to be extremely effective in removing lead

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

from industrial wastewaters. A pilot plant was designed to evaluate and perfect the treatment of lead-containing wastewaters by foam flotation. Objectives of the project were to obtain consistent effluent lead concentrations less than 0.10 milligrams per liter; to increase the hydraulic loading rate while maintaining effluent quality; to develop a sodium lauryl sulfate recycle system; to evaluate the effect of raising the column dispersion head to reduce high air requirements and foam clotting at the top of the column; and to generate cost data on lead removal. Advantages of colloid foam flotation are the simplicity and effectiveness of the method, its moderate costs, the production of a concentrated and easily handled sludge, and the relatively small amount of space required for a complete adsorbing colloid foam flotation system. (Carroll-FRC) W83-00154

#### ADVANCED TREATMENT.

Public Works, Manual, p D35-D42, 1982. 4 Fig.

Descriptors: \*Advanced wastewater treatment, \*Tertiary wastewater treatment, \*Mechanical equipment, Ion exchange, Chemical treatment, Disinfection, Filters, Screens, Adsorption, Biological filters, Clarification, \*Wastewater treatment, Land disposal, Spray irrigation.

Advanced or tertiary wastewater treatment is discussed. Solids can be removed using multi-media filters or micro-strainers, and nutrients and organics can be absorbed by carbon filters, ion exchange processes, and biological filters. Chemicals are used to reduce suspended solids, control phosphorus, and thicken sludge. Physical-chemical treatment plants are primary plants which meet the standards set for advanced treatment. Components of the system are: pretreatment, clarification, filtration, adsorption, and disinfection. Land application is a method which can result in zero discharge of treatment effluents into waterways. Overland flow and spray irrigation systems result in further renovation of treated wastewater. Equipment designed for the treatment methods discussed is listed, including suppliers. (Small-FRC) W83-00151

#### SLUDGE DIGESTION AND DISPOSAL.

Public Works, Manual, p D42-D53, 1982.

Descriptors: \*Sludge digestion, \*Sludge disposal, Mechanical equipment, Digestion, Biodegradation, Sludge, \*Wastewater treatment, Anaerobic digestion, Biological treatment, Aerobic digestion, Sludge drying, Incineration, Chemical treatment.

Treatment processes applied to sludge digestion and disposal are discussed. Equipment and processes used in anaerobic digestion include tanks, fermentation process, sludge handling, gas collection, supernatant disposal, mixing and scum breaking floating covers, and sludge heaters. Aerobic digestion equipment is also described. Equipment for utilization of gas produced during the digestion process, chemicals for stabilizing raw sludge, and sludge dewatering devices are also listed. Sludge can be used as fertilizer with the help of equipment including tank trucks, sludge shredders, composters, and codisposal processes with solid wastes. Equipment is available for drying filter cake and for the incineration, wet-air oxidation, or fluidized-bed incineration of sludge. Sources are listed for most of the equipment described. (Small-FRC) W83-00152

#### DISINFECTION, ODOR PREVENTION AND CONTROL.

Public Works, Manual, p D53-D57, 1982.

Descriptors: \*Disinfection, \*Odor control, \*Chlorination, \*Ozonation, Odors, \*Wastewater treatment, Chlorine, Ozone, Advanced wastewater treatment, Bromine chloride, Sulfur dioxide, Hydrogen sulfide, Chemical treatment, Mechanical equipment.

Final treatment of effluent from secondary or advanced treatment processes often includes disin-

fection, odor prevention, and odor control. Disinfection is achieved through the use of chlorine, ozone, or ultraviolet radiation. Bromine chloride and sulfur dioxide are alternatives to chlorine treatment. Control of hydrogen sulfide is important at a disinfection facility. Odor prevention and control are implemented using deodorizing chemicals and odor combustion and adsorption. Equipment and chemicals available for disinfection and odor control are described and sources are given. (Small-FRC) W83-00154

#### OPERATION CONTROL.

For primary bibliographic entry see Field 5G. W83-00155

#### SEWER MAINTENANCE AND REHABILITATION.

Public Works, Manual, p D62-D67, 1982.

Descriptors: \*Maintenance, \*Sewer systems, \*Leakage, \*Cleaning, Pipes, Sewers, Mechanical equipment, Safety, Current meters, Conveyance structures.

Equipment for the inspection, cleaning, and repair of sewer systems is discussed. Equipment is available to evaluate sewer performance including inflow meters, infiltration/inflow analysis, and smoke testing. Equipment designed to remove obstructions in sanitary sewer lines includes hydraulic propelled devices, mechanical rodding equipment, machines for direct removal such as sand removal, hydraulic pressure rodding, and chemicals. Television inspection of cleaned lines is useful. Equipment and products are available for the rehabilitation of sewer lines or the sealing of leaks and breaks. Contractors are listed who provide sewer cleaning, major repair, or locating services. Safety equipment for maintenance crews is also described. Suppliers are listed for most of the types of equipment discussed. (Small-FRC) W83-00156

#### CONTROL OPERATIONS AND MAINTENANCE SERVICES.

Public Works, Manual, p D67-D71, 1982.

Descriptors: \*Wastewater facilities, \*Administration, \*Maintenance, \*Process control, Optimization, Water treatment facilities, Operating policies, Professional personnel, Planning, Contracts, Computers, Automation.

Control of operations and maintenance services of wastewater treatment plants is discussed including a consideration of private sector firms offering full and partial services. The advantages and disadvantages that contract operations firms can offer are considered in the areas of process optimization, budget systems and financial control, at-site management teams, organizational structure and administrative skills, computerization, preventive maintenance, and certification training. Information is also presented on how to select a private contractor. In general, the firms can provide useful professional assistance to operators of wastewater and sewage treatment plants. Computerization is a special strength of many contractors and can increase plant efficiency and improve preventive maintenance programs. (Small-FRC) W83-00157

#### WATER RECLAMATION AND REUSE.

Alberta Univ., Edmonton. Dept. of Civil Engineering.

S. E. Hrudey.

Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 654-673, June, 1982. 402 Ref.

Descriptors: \*Literature reviews, \*Water reuse, \*Reclaimed water, \*Water renovation, \*Reviews, Water conservation, Impaired water use, Wastewater irrigation, Wastewater reclamation, Industrial wastewater, Municipal wastewater, Irrigation water, Aquaculture, Groundwater recharge, Recharge, Infiltration, Public health, Fate of pollutants.

A review of recent literature on water reclamation and reuse was divided into several headings: general; agriculture and irrigation; groundwater recharge; industrial water reuse; municipal, commercial, and domestic reuse; health considerations of using reclaimed water; and technology development. Books, manuals, and reviews on water reuse and conservation were described. Several papers concerned reuse of reclaimed wastewaters or irrigation tail water for agricultural irrigation. Tannery wastewater proved useful in rehabilitation of sodic soil in Pakistan. Salt tolerant crops were irrigated with cooling water blowdown. Many investigators were concerned with reuse of municipal wastewater in irrigation. Performance of sugarcane, corn, cotton, and alfalfa crops irrigated with wastewater effluent was better than that obtained through irrigation with conventional irrigation water. Wine grapes were adversely affected by wastewater irrigation. Cooling water effluents and some municipal wastewaters were suitable for use in aquaculture systems; some domestic wastewaters and landfill leachates were not. Recycling treated wastewater into wetlands was an inexpensive and acceptable disposal alternative. Groundwater recharge with wastewater effluent was studied in several sites. Some contaminants were satisfactorily removed by the infiltration process; chlorinated hydrocarbons and viruses tended to break through. (Cassar-FRC) W83-00163

#### PULP AND PAPER EFFLUENT MANAGEMENT.

Tufts Univ., Medford, MA.; and National Council for Air and Stream Improvement, Inc., Medford, MA.

G. W. Gove.

Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 704-716, June, 1982. 130 Ref.

Descriptors: \*Literature reviews, \*Pulp and paper industry, \*Wastewater treatment, \*Industrial wastewater, \*Reviews, Paper industry, Pulp wastes, Kraft mill wastes, Bleaching wastes, Water reuse, Water conservation, Oxygen demand, Water pollution effects, Aquatic life, Fish, Mutagens, Toxicity, Organic compounds, Wastewater analysis, Oxidation, Sulfite liquors, Fermentation, Membrane processes, Sludge, Incineration, Biological treatment, Anaerobic digestion, Phenols.

A review of current literature on management of pulp and paper effluents included receiving waters, biological effects, effluent characterization, pulping treatment, and biological treatment. Several general papers concerned environmental regulations, federal hazardous waste regulations, the progress in Canada's pulp and paper industry water pollutant abatement program, and economic aspects of environmental protection measures. Several literature reviews and papers covered developments in effluent sources and treatment. Studies on biological effects of pulp and paper mill effluents included fish development, bioaccumulation of resin acids in trout, bioassays on fish and invertebrates, and mutagenicity of effluents and sediments. Methods for characterizing effluents were developed or improved for the following categories: priority pollutants, effluent limitations, BOD and COD, toxic compounds, anthraquinone, chlorinated compounds, and components of process streams and effluents. Pulping liquor disposal and recovery was accomplished by several methods of chemical recovery (wet air oxidation, ultrafiltration and reverse osmosis, and oxygen delignification). Recovery of byproducts and reduction of waste loads was done by fractionation and fermentation. Physicochemical treatment methods included water reuse and spill control by total suspended solids monitoring, effluent recycling, vacuum pump seal water recovery, removal of solids by gravity straining, and slime control. (Cassar-FRC) W83-00164

#### ADSORPTION OF TOXIC AND CARCINOGENIC COMPOUNDS FROM WATER.

Michigan Univ., Ann Arbor. Dept. of Environment and Water Resources Engineering.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

For primary bibliographic entry see Field 5F.  
W83-00171

**REMOVING SOLUBLE ORGANIC CONTAMINANTS BY LIME-SOFTENING,**  
Illinois Univ. at Urbana-Champaign. Dept. of Civil  
Engineering.  
For primary bibliographic entry see Field 5F.  
W83-00172

**IMPROVEMENT IN COAL PREPARATION—  
WATER CLARIFICATION THROUGH POLY-  
MERIC FLOCCULATION,**  
Dow Chemical Co., Tulsa, OK. Dowell Div.  
W. C. Foshee, M. J. Swan, and R. R. Kliment.  
Mining Engineering, Vol 34, No 3, p 293-297,  
March, 1982. 8 Fig, 2 Tab, 5 Ref.

Descriptors: \*Wastewater treatment, \*Chemical  
coagulation, \*Flocculation, Prediction, Coal,  
Wastewater renovation, Performance evaluation,  
Economic aspects, Cost analysis.

Coal preparation plants use large volumes of water, necessitating the use of water recycling technology. Economical cleansing of dirty water in these plants usually requires flocculation with an efficient organic polyelectrolyte. The usefulness of laboratory data for predicting relative flocculant and coagulant results in the wastewater treatment systems for these plants was investigated. A modified cylinder settling test and a laboratory model Enviro-Clear Clarifier were used to obtain laboratory solids concentration data. Full scale field trials were then used to confirm the laboratory results. The tests were designed to compare the performances of two coagulants with and without a flocculant pretreatment. The tests showed that the chemicals investigated used a combination of charge effect neutralization and polymer bridging in the treatment of the wastewater slurries. The presence of a strong flocculant bridging mechanism reduced the level of coagulant required and, to some extent, reduced the differences between types of coagulant chemicals. The use of a small amount of flocculation pretreatment was more efficient than a pure coagulation approach in treatment of the wastewater studied. Although waste slurries not requiring charge neutralization can be treated with flocculant alone, a combined flocculant/coagulant system provided better plant economics for the wastes studied than either flocculants or coagulants alone. The cylinder testing provided a simple, quick, and effective screening tool for identifying the best polymers to be used for the water clarification system and for determining treatment sequence. Full-scale plant tests must be used to confirm the laboratory test results, to optimize treatment, and to make a final economic evaluation. (Carroll-FRC)  
W83-00177

**EFFECT OF ACTIVATED SLUDGE OPERATIONAL CONDITIONS ON SLUDGE THICKENING CHARACTERISTICS,**  
Chulalongkorn Univ., Bangkok (Thailand). Dept. of  
Sanitary Engineering.  
M. Tuntoolavest, and C. P. L. Grady, Jr.  
Journal of the Water Pollution Control Federation,  
Vol 54, No 7, p 1112-1117, July, 1982. 2 Fig, 5  
Tab, 5 Ref.

Descriptors: \*Activated sludge process, \*Clarification,  
\*Sludge thickening, \*Wastewater treatment,  
Biological wastewater treatment, Sludge volume  
index, Sludge solids, Mixed liquor solids, Settling  
velocity.

Two 348 liter activated sludge pilot plants were operated in parallel at 1.9 liters per minute flow rate and solids retention time of 10 days to determine the effects of operational parameters on sludge thickening characteristics. Sludge volume index (74-139 ml per g) and zone settling velocity data revealed no clear effects of mixed liquor suspended solids concentration (1254-3117 mg per liter), air flow rate (4.53-6.80 cu m per hour), and sludge recycle ratio (30%-80%) on sludge thickening. Since clarification is significantly affected by the same conditions, it should be possible to adjust

the operational conditions in a plant to produce optimum clarification characteristics without a great risk of adversely affecting its sludge thickening properties. (Cassar-FRC)  
W83-00179

**MANPOWER NEEDS IN WASTEWATER  
TREATMENT AND COLLECTION SYSTEMS  
FOR THE YEARS 1980 TO 2000,**  
Southern Illinois Univ. at Edwardsville. Environmental  
Resources Training Center.

For primary bibliographic entry see Field 5G.  
W83-00180

**STABILIZING HIGH-STRENGTH WASTES  
WITH PHOTOSYNTHETIC BACTERIA,**  
Orange Free State Univ., Bloemfontein (South  
Africa). Inst. for Environmental Science.

D. F. Toerien, T. E. Cloete, P. J. Du Toit, and P.  
J. Botes.  
Water SA, Vol 8, No 2, p 92-96, April, 1982. 1 Fig,  
4 Tab, 17 Ref.

Descriptors: \*Photosynthetic bacteria, \*Feedlot  
wastes, \*Waste treatment, \*Organic wastes,  
Wastewater treatment, Sludge, Bacteria, Fermentation,  
Algae, Animal wastes, Farm wastes,  
Manure, Feedlot runoff, Barn wastewater, Agricultural  
runoff.

The COD of concentrated organic wastes (sewage sludge and cattle feedlot effluent) was reduced by over 90% in a system combining 3 units: fermentation, photosynthetic bacterial degradation, and algae. This operation was done in the laboratory and in small outdoor units. For example, cattle feedlot effluent, COD 25,920 mg per liter and BOD 500 mg per liter, was subjected to fermentation for 2 days in the outdoor unit under autumn conditions (12-23°C daily temperature range). Organic matter was degraded into a fatty acid mixture, COD 14,634 mg per liter and BOD 480 mg per liter. In the second unit photosynthetic bacteria decomposed the fatty acid mixture during an 8 day detention time to a mixture with 11,480 COD mg per liter and 450 BOD mg per liter. Further exposure in the algae unit for 8 days reduced COD to 1842 mg per liter and BOD to 190 mg per liter. Final chlorophyll a concentration was 1200 micrograms per liter. The outdoor unit also produced good results under winter conditions, 0-20°C. The resulting product showed promise as a single cell protein source. (Cassar-FRC)  
W83-00181

**WATER MANAGEMENT IN THE OIL SHALE  
INDUSTRY,**

CH2M/Hill, Bellevue, WA.  
J. D. Mavis, Jr., and R. M. Rosain.  
Chemical Engineering Progress, Vol 78, No 6, p  
61-69, June, 1982. 5 Fig, 3 Tab, 22 Ref.

Descriptors: \*Wastewater treatment, \*Oil shale,  
\*Mine wastes, \*Water management, Wastewater  
renovation, Leachates, Mine drainage, Wastewater  
disposal, Waste disposal, Water reuse, Shales,  
Wastewater management, Land disposal, Heavy  
metals, Activated carbon.

At present 40 private companies and the United States Navy have over 2,850 sq km of oil shale holdings. Shale oil production generates solid, liquid and gaseous wastes. Both in-situ and surface retorting of shale have the potential for polluting water through retort water, off-gas condensates, and mine water. Surface retorting operations also produce spent shale leachate. Direct surface discharge and land application of wastewaters connected with shale oil production have been found to be unfavorable due to their high salt content, heavy metal concentrations and levels of boron, fluoride and other organics. The disposal of shale oil wastewater by treatment and discharge or wastewater reuse are more viable alternatives. Some advantages of wastewater reuse on the shale oil mining site are listed. To select a suitable wastewater treatment operation, the most cost-effective reuse options should be identified. Solid wastes originating from clarification and media filtration can be dewatered and disposed of with

spent shale. Possible treatment technologies for off-gas condensate and potential uses for recovered water are considered. Organics have been most successfully removed from retort waters by mechanical evaporation followed by activated sludge bio-oxidation of the distillate, followed by activated carbon treatment. Synfuel wastewater treatment options are currently being studied by several private industries, government and energy and environmental agencies. (Geiger-FRC)  
W83-00185

#### FIXED-FILM BIOLOGICAL PROCESSES,

J. Josephson.  
Environmental Science and Technology, Vol 16,  
No 7, p 380A-384A, July, 1982. 2 Fig, 1 Ref.

Descriptors: \*Biological wastewater treatment,  
\*Films, \*Trickling filters, \*Anaerobic digestion,  
Wastewater treatment, Aerobic digestion, Methane,  
Filter media, Rotating biological contactors,  
Microorganisms, Industrial wastewater, Acclimation.

Fixed film biological treatment systems have several advantages over the conventional activated sludge process—energy savings or net energy production, resistance to toxic materials, and smaller size. Examples are trickling filters, rotating biological contactors, and anaerobic systems. Development of improved filter media to replace gravel and stones greatly reduced the area of land required for a treatment facility. The fixed film of microorganisms forms on the surface of the shaped inert media (polyvinyl chloride, other plastics, stainless steel, redwood, etc.) and biodegrades and adsorbs polluting materials. Fixed film systems have some disadvantages such as difficulty in building up biomass in the beginning of operations (as long as 3 months), limited loading rate, and an inability to treat high waste concentrations. Most of the presently-operating systems are aerobic. Some are arranged for countercurrent flow (air or oxygen upward and wastewater flow downward) and some for crossflow. The biofilm thickness is kept under control by predators living on the filter and by hydraulic activity of the fluid flow. Anaerobic system development is currently active. Advantages include greatly reduced sludge production, generation of 70-85% methane-containing gas, no required energy input, and low nutrient requirements. It was possible to design anaerobic systems for treatment of specific industrial wastewaters such as phenol. Experimental addition of 50 mg per liter Cr(6+) to wastewater in a rotating biological contactor system affected nitrification by impairing the function of Nitrosomonas, the nitrite oxidizer. Nitrobacter, the ammonium oxidizer, was less damaged. Recovery was observed in a week. Tests of shock loads of a variety of toxic chemicals showed declines in methane production but resilient recovery to normal operation. Microorganisms acclimating to 10-25 times the usual harmful dose were observed. (Cassar-FRC)  
W83-00191

#### DIGESTER CONTROL PAYS DIVIDENDS,

Hinsdale Sanitary District, IL.  
J. Higgins, and D. Stoltzenberg.  
Water/Engineering and Management, Vol 129, No  
8, p 54, 56, 58, July, 1982. 3 Fig.

Descriptors: \*Anaerobic digestion, \*Wastewater  
treatment, \*Sludge digestion, Activated sludge  
process, Hinsdale, Illinois, Wastewater facilities,  
Control systems.

A sludge blanket detector was incorporated into a system for control of the supernatant liquid in an anaerobic digestion process at the Hinsdale Sanitary District Plant, Illinois. The 12 mgd activated sludge plant includes rapid sand filtration for tertiary treatment, aerobic digestion of waste activated sludge, and anaerobic digestion of all other sludges. A worksheet was devised to easily tell the operator the supernatant situation in each secondary digester, which has 3 drawoff ports. The sludge level detector is used to remotely indicate the border between clear and turbid liquid. The worksheet makes it possible to systematically

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

record measured liquid levels, choose the appropriate withdrawal port, and calculate the volume of supernatant and pounds of BOD in the withdrawn liquid. This permits recycling of supernatant into the headworks during periods of low organic and/or hydraulic loading, usually at night. Clay-lined lagoons are available for temporary storage. (Cassar-FRC) W83-00192

#### EFFECT OF A BACTERIAL CULTURE PRODUCT ON BIOLOGICAL KINETICS.

Texas Univ. at Arlington. Dept. of Civil Engineering. S. R. Qasim, and M. L. Stinehelfer. Journal of the Water Pollution Control Federation, Vol 54, No 3, p 255-260, March, 1982. 8 Fig, 5 Tab, 6 Ref.

Descriptors: \*Activated sludge process, \*Bacteria, Performance evaluation, \*Wastewater treatment, Kinetics, Biological wastewater treatment, Process efficiency.

Two identical laboratory units operating under similar conditions were used to evaluate the performance of a bacterial culture product on a continuous-flow activated sludge process. The biological kinetic coefficients were developed by operating one unit with the addition of the bacterial culture product and using the laboratory unit as a control. Bench-scale batch reactors were used to determine the optimum dosage of the bacterial culture product, while bench-scale, continuous flow activated sludge reactors were used to evaluate the biological growth kinetics. The bacterial culture product tested was found to have some effect on the sludge growth yield coefficient and on the decay coefficient, although it had no effect on the substrate utilization coefficients. The product had little effect on the overall performance of a well-designed and well-operated activated sludge treatment plant, although it might have some benefit in plants which are already overloaded or operating at poor organic removal efficiencies. The procedure used in this study provides a systematic and rational approach to the evaluation of the effect of bacterial culture products on biological treatment plants under different operating conditions. (Carroll-FRC) W83-00212

#### NON-CONTACTING ULTRASONIC FOR FLOW AND LEVEL CONTROL.

K. V. Beard. Effluent and Water Treatment Journal, Vol 22, No 5, p 199, May, 1982.

Descriptors: \*Water treatment facilities, \*Ultrasonics, Design criteria, Planning, \*Wastewater treatment, Measuring instruments.

Increased usage of automated plants in the treatment of both industrial waste and sewage is being seen in the water industry. One particular area of development is the control and monitoring of water and effluent levels and flow rates. The need arose for a system which would detect or measure levels without contacting the media. The system would operate continually without the need for constant checking and adjustment and it would have to be unfailingly accurate. An ultrasonic transducer package has been developed which dispenses with the need for reflectors and pre-amplifiers, produces an electronic control unit able to filter out all spurious signals, and converts the time taken for the sonic pulse to reach the media. Despite extreme sensitivity, such units are remarkably tough measuring instruments being dust and vibration proof and unaffected by rain and heat. The ultrasonic transducer package means that rather than having to send personnel down to the bottom of wet wells or sumps in which the probe is placed, the unit is freely accessible at the top of the vessel. Another development is the ultrasonic flow, or open channel, meter. By measuring with extreme accuracy the change in level in open channels or weirs, where the normal flow rate is known, one can obtain instant and extremely accurate signals of flow changes, thus initiating alarms, pumps or gauges as required. An example is offered in the

West Midland sewage treatment works. (Baker-FRC) W83-00221

#### COLIFORM ATTACHMENT TO SUSPENDED PARTICLES IN STORMWATER.

Michigan Univ., Ann Arbor. School of Public Health.

For primary bibliographic entry see Field 5B. W83-00224

#### NUTRIENT REMOVAL FROM WASTEWATER BY WETLANDS.

North Central Forest Experiment Station, Grand Rapids, MN. D. S. Nichols.

In: Proceedings, 6th International Peat Congress, August 17-23, 1980, Duluth, Minnesota. W.A. Fisher Company, Eveleth, Minnesota, 1981. p 638-642, 2 Fig, 1 Tab, 61 Ref.

Descriptors: \*Wastewater management, \*Wetlands, \*Nitrogen removal, \*Phosphorus removal, \*Nutrient removal, \*Literature review, Wastewater, Water quality, Water quality control, Wastewater disposal, Wastewater discharge, Wastewater lagoons, Wastewater treatment, Phosphorus, Nitrogen, Denitrification, Ammonium, Nitrates.

The literature on the capacity of wetlands for removing nitrogen (N) and phosphorus (P) from wastewater was reviewed and assessed. Retention of inflowing P under natural conditions appears to be limited to the relatively small amount of P that is accumulated as peat is formed from partially-decayed vegetation. Some P is absorbed by the soil when above-natural levels are added to a wetland. Wastewater P is most efficiently removed at low loading rates, and efficiency decreases rapidly as loading rates increase. Further, P removal declines with time; hence, short-term studies can give misleadingly high estimates of ultimate P removal capacity. Removal of N in excess of the natural accumulation rate in the peat is apparently by denitrification. As with P, N removal efficiency decreases rapidly as wastewater N loading rates are increased. The denitrification rate may be limited by the nitrification rate of ammonium-N, nitrate-N, or by oxygen diffusion. From the sparse literature data available, it is estimated that 1 ha of wetland would be needed to remove 75% of the P and N generated by 15 and 20 people, respectively, or to remove 54% of the P and N generated by 50 people. Hence, wetland application is feasible only where wetlands are abundant and population densities are low. Large populations cannot be served by this means. (Zielinski-MAXIMA) W83-00226

#### CAUSE OF INEFFICIENT SOLIDS SEPARATION IN THE ACTIVATED SLUDGE PROCESS.

Delaware Univ., Newark. Water Resources Center.

R. I. Dick, and J. H. Johnson, Jr. Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108381, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, June 1982. 32 p, 7 Fig, 4 Tab, 8 Ref. OWRT A-034-DEL(2), 14-34-0001-7016.

Descriptors: \*Activated sludge process, \*Particulate matter, \*Clarified wastewater, \*Suspended solids, \*Wastewater facilities, Activated sludge, \*Wastewater treatment, Sludge, Solids waste disposal, Clarification, Water treatment, Pilot plants, Sedimentation, Settling tanks, Sedimentation rates, Overflow, Effluents, Flow rates, Water treatment facilities.

Research was conducted to examine why particles are contained in clarified effluent from activated sludge final sedimentation tanks which are not subjected to solids overload, since, in principle, particles should not exist above the feed-level of underloaded sedimentation tanks. The results of this study suggested that the presence of clarified effluent particles could arise from selective removal of slow settling particles from the thickening

portion of the tank, or by displacement of sludge into the clarification portion of the tank, or by displacement of sludge into the clarification portion of the tank with subsequent sedimentation of rapidly settling particles. Since pilot scale sedimentation tank inlet port diameter was found to have a significant effect on clarification performance, the latter interpretation may be appropriate. As anticipated, solids that escaped from sedimentation tanks tended to be smaller and lighter than those captured. Three aspects investigated on this study to assess the cause of solids loss were: closely-controlled pilot scale tests with a surrogate (calcium carbonate) suspension; examining solids properties captured/lost at full-scale activated sludge treatment plants; and operating a pilot-scale final sedimentation tank at an activated sludge wastewater treatment plant. High overflow rates caused a deterioration of pilot plant performance. (Zielinski-MAXIMA) W83-00232

#### WASTEWATER FLOCCULATION-FILTRATION AND POST DISINFECTION.

Sulzer Bros. Ltd., Winterthur (Switzerland). J. C. Ginocchio, H. Gros, H. Bischofberger, and A. Gmunder.

Water Services, Vol 86, No 1036, p 267-270, June, 1982. 13 Fig, 2 Tab, 4 Ref.

Descriptors: \*Flocculation, \*Filtration, \*Disinfection, \*Wastewater treatment, Bacteria, Trihalomethanes, Chlorinated hydrocarbons, Advanced wastewater treatment, Chlorination, Chloriforms, Turbidity, Metals, Organic matter, Switzerland.

A flocculation-filtration granular media pilot plant was installed at a municipal wastewater treatment plant to study the elimination of coliforms, enterococci, spore-forming bacteria, viruses, parasites, and other substances present after mechanical and biological treatment. Flocculants tested were ferric sulfate, ferric sulfate, aluminum sulfate, and aluminum polyhydroxy chloride. Turbidity was reduced from 30 to 1.5 NTU. Phosphorus removal was 80%, but it was difficult to reach a P level lower than 1 g per cu m without using a two-stage process. Removals of Fe were to less than 0.3 g per cu m; Cd, Cu, and Pb, 75%; Zn, 50%; and Ni, not removed. Levels of many organic pollutants were also substantially reduced. Bacterial levels were reduced by flocculation-filtration as follows: coliforms, from over 10 million per 100 cu m in raw water to < 10,000 per 100 cu m; spore-forming bacteria, from 308-842 per cu m in raw water to < 0.1-2 per cu m after flocculation-filtration and, 0.1-1 per cu m after subsequent chlorination; total bacteria, from over 20,000 per cu m in raw water to 5000 per cu m. Chlorination post-disinfection was achieved faster and with much less residual chlorine using flocculation-filtration than with untreated effluent. The flocculation-filtration process had practically no beneficial effect on reduction of chloroform during post-chlorination. (Cassar-FRC) W83-00239

#### HIGH PH STABILIZATION OF WASTEWATER SLUDGE USING CHEMICAL SOFTENING WASTES FROM WATER TREATMENT.

Iowa Univ., Iowa City. Dept. of Civil Environmental Engineering. R. R. Dague.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108472, Price codes: A04 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute ISWRRI-99, Iowa State University, Ames, June 1982. 59 p, 33 Fig, 1 Tab, 32 Ref. OWRT A-062-IA(2), 14-34-0001-7034.

Descriptors: \*Bacterial analysis, \*Hydrogen ion concentration, \*Sludge, \*Water treatment, \*Wastewater treatment, \*Alkalinity, \*Sludge disposal, Coliforms, Aerobic bacteria, Disinfection, Lime Alkaline water, Chemical treatment, Water quality, Water quality control, Water softening, Wastewater renovation, Activated sludge, Streptococcus.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

An alternative to the independent disposal of wastewater treatment sludge and chemical water softening sludge is to combine the two sludge types in a common system for high pH stabilization of the wastewater sludge, followed by dewatering and disposal of the combined sludge. Laboratory assessment of this alternative concluded that fecal coliform bacteria in primary wastewater sludge could be close to totally killed within one hour at pH levels ranging from pH 11.0-12.2 at 20 and 30 degrees. The pH should be maintained at no less than 11.5 for up to 24 hours. Kills of total aerobes and fecal streptococci required up to pH 12.2. Short-time exposure at pH 12 also killed microorganisms in primary and secondary activated sludge. Addition of water treatment sludge to primary wastewater sludge for combined high pH treatment reduces the make-up lime requirement and will improve filtrate and decant quality as the water/wastewater sludge ratio increases. Addition of the softening sludge to wastewater for high pH treatment did not, however, reduce lime requirements to achieve pH levels of 11.0 or 11.5. It concluded that there may be both cost and operational performance advantages to combined water and wastewater sludge treatment at high pH. (Zielinski-MAXIMA)  
W83-00243

**DEVELOPMENT OF CHLORINE RESISTANT MEMBRANES, POLYIMIDE MEMBRANES AND POROUS SUBSTRATES,**  
Membrane Systems, Inc., San Diego, CA.  
For primary bibliographic entry see Field 3A.  
W83-00246

**A CURRICULUM FOR WATER SUPPLY AND WASTEWATER OPERATION, MAINTENANCE AND MANAGEMENT,**  
District of Columbia Univ., Washington. Water Resources Research Center.  
For primary bibliographic entry see Field 5G.  
W83-00247

**WASTEWATER MANAGEMENT PROBLEMS IN RURAL COMMUNITIES,**  
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W83-00249

**THE LAUREL RUN ACID MINE DRAINAGE RENOVATION DEMONSTRATION FACILITY: AN EVALUATION,**  
Pennsylvania State Univ., University Park. Coll. of Agriculture.  
For primary bibliographic entry see Field 5G.  
W83-00258

**ALGAL CONCENTRATION AND SPECIES COMPOSITION IN EXPERIMENTAL MATURATION PONDS WITH EFFECTS OF AERATION AND RECIRCULATION,**  
National Inst. for Water Research, Pretoria (South Africa).  
S. N. Shillinglaw, and A. J. H. Pieterse.  
Water SA (Pretoria), Vol 6, No 4, p 186-195, October 1980. 3 Fig, 3 Tab, 16 Ref.

Descriptors: \*Humus sludge, \*Wastewater treatment, \*Stabilization ponds, \*Algal growth, \*Aerated lagoons, Wastewater facilities, Wastewater disposal, Wastewater collection, Effluents, Effluent streams, Effluent seepage, Lagoons, Storage reservoirs, Water circulation, Instream aeration, Algae, Eutrophication.

Three experimental maturation pond systems receiving humus tank effluents from a conventional sewage treatment works were studied over a 12-month period. The effects of aeration and recirculation of pond water on algal concentrations was compared with no agitation of pond water. Further, the algal composition of the systems was examined with emphasis on the non-agitated (control) system. The algal concentrations of all three pond systems showed wax and wane patterns. The aerated system appeared to be the most efficient in

terms of maintaining a high algal concentration. Algal concentration declined during summer and winter months in the recirculated and non-agitated systems, but only during the summer in the aerated system. Possible reasons for the observed algal concentration pulses and subsequent declines are discussed. The aerated system also had the highest mean chlorophyll a concentration, suggesting that pond water aeration was most favorable for algal growth. Aeration also reduced the number of algal concentration pulses in the system. Recirculation did not increase algal concentration. (Zielinski-MAXIMA)  
W83-00284

**EVALUATION AND CONTROL OF SIDESTREAMS GENERATED IN PUBLICLY OWNED TREATMENT WORKS,**  
Weston (Roy F.), Inc., West Chester, PA.  
R. Ball, M. Harris, and K. Deeny.  
Environmental Protection Agency Project Summary EPA-600/S2-82-016, May 1982. 9 p, 3 Fig, 4 Tab. 68-03-2775.

Descriptors: \*Wastewater treatment, \*Sidestreams, \*Algorithms, Wastewater facilities, Effluents, Performance evaluation, Decision making, Design criteria.

Many performance problems at Publicly Owned Treatment Works (POTW) are allegedly the result of recycling sidestreams within the POTW. Sidestreams often carry significant quantities of organic and inorganic materials either in solution or suspended form. A process matrix was developed to categorize sidestream volumes and strengths typical of various types of POTW's. From this matrix, the impact of the sidestreams on overall POTW performance and effluent quality was determined, and operational evaluation and control procedures and design information to minimize their impact were developed. Evaluation algorithms were developed to evaluate mainstream treatment processes primarily with respect to the impact of sidestreams. Control algorithms were developed to be used as guides in making operational changes at the mainstream and sidestream processes to control the impact of the sidestreams. Through the proper use of the algorithms, a point is reached where all applicable operational methods to reduce the sidestream impact have been performed. Decision points included in the algorithms refer the user to design methods to control sidestream impacts in the event that all of the operational methods have been unable to reduce the impacts to acceptable levels. (Moore-SRC)  
W83-00291

**SLUDGE DISPOSAL FROM ACID MINE DRAINAGE TREATMENT,**  
Bureau of Mines, Pittsburgh, PA. Pittsburgh Research Center.

For primary bibliographic entry see Field 5E.  
W83-00298

**INSTRUMENTAL METHODS OF MONITORING AND CONTROL OF WATER AND WASTEWATER TREATMENT PROCESSES,**  
Taylor (John) and Sons, London (England).  
For primary bibliographic entry see Field 5F.  
W83-00314

**PRELIMINARY STUDIES ON THE TREATMENT OF CANNING FACTORY EFFLUENT WITH AN INTEGRATED BACTERIAL-ALGAL-FISH SYSTEM,**  
Orange Free State Univ., Bloemfontein (South Africa). Inst. for Environmental Sciences.  
I. G. Gaigher, T. E. Cloete, and D. F. Toerien.  
Water SA, Vol 8, No 2, p 97-100, April, 1982. 4 Fig, 1 Tab, 11 Ref.

Descriptors: \*Food-processing wastes, \*Algae, \*Bacteria, \*Wastewater treatment, Canneries, Photosynthetic bacteria, Fish, Organic wastes.

A bacterial-algal-fish system decreased the COD of a canning factory effluent by 98%. The effluent had a mean pH of 4.5, BOD of 528 mg per liter,

and COD of 3116 mg per liter. The waste matter was fermented on a laboratory scale for 24 hours at 37 C to produce a fatty acid mixture, which was in turn subjected to 8 days retention in a photosynthetic bacterial unit and 8 days in an algal unit. The resulting algal mass was fed to fish, *Oreochromis mossambicus*. Mean COD and BOD (in mg per liter) at the different stages were: end of bacterial unit treatment, 225 and 170, respectively; and end of algal growth, 60 and 41, respectively. Mean total suspended solids (in g per liter) were 1.3 in the canning effluent, 1.8 in the photosynthetic bacteria unit, and 0.09 in the algal unit. Final pH was 7.8. The water from the algal unit met South African standards for drinking water with respect to BOD, COD, phosphate, and ammonium. (Cassar-FRC)  
W83-00317

**TREATMENT OF OILY WASTEWATERS FROM ONSHORE OPERATIONS,**  
Rockwell International, Newbury Park, CA. Environmental Monitoring and Services Center. I. Lysyj.

Journal of the Water Pollution Control Federation, Vol 54, No 3, p 309-315, March, 1982. 1 Fig, 5 Tab, 3 Ref.

Descriptors: \*Wastewater treatment, \*Oily water, \*Water pollution control, Ships, Wastewater facilities, Oil pollution, Industrial wastewater, Performance evaluation, Hydrocarbons, Ballast, \*Alaska.

The operations of the Port Valdez, Alaska, facility for the treatment of ballast water from oil tankers were studied in order to determine the capabilities and limitations of a modern state-of-the-art oil waste treatment plant in dealing with ever-increasing quantities of waste from energy-related operations. The Port Valdez facility utilizes primary treatment by gravity separation under quiescent aging conditions in above-ground and steel-concrete storage tanks, followed by a secondary treatment consisting of a chemically aided flocculation and a dissolved air flotation process (with capability for a final pH adjustment) plus an effluent impoundment basin. The treatment plant was found to be effective in reducing the free oil content of the ballast water, achieving a 99.8% reduction in the organic load. Most of the organic content reduction was achieved in the gravity separator, with the dissolved aeration-flootation unit adding relatively little to the treatment process. The average concentration level for aromatic hydrocarbons was found to be 9 milligrams carbon per liter in the primary effluent and 5 milligrams carbon per liter in the final effluent. Since the volume of ballast water treated at the Port Valdez facility is about 15 million gallons per day, significant amounts (about 70 gallons per day) of aromatic hydrocarbons are discharged daily by the plant. (Carroll-FRC)  
W83-00319

**POTENTIAL APPLICATIONS OF WATER HYACINTH FOR WATER, AIR RECYCLING IN CLOSED SYSTEMS,**  
Maryland Eastern Shore Univ., Princess Anne. Dept. of Natural Science.  
For primary bibliographic entry see Field 5G.  
W83-00324

**SECONDARY TREATMENT.**  
Public Works, Manual, p D27-D35, 1982.

Descriptors: \*Secondary wastewater treatment, \*Suspended solids, \*Organic matter, \*Activated sludge process, \*Aeration, \*Oxidation, \*Biological filters, Filters, Wastewater oxidation, Trickling filters, Mechanical equipment, Wastewater treatment, Activated sludge, Oxidation ponds, Biological oxidation, Rotating disc filters.

Secondary treatment of wastewater for the removal of fine suspended solids and dissolved organic matter is discussed. The activated sludge process can utilize equipment for diffused aeration, mechanical aeration, combined aerators and clarifiers and steel basin fabricators, and modified activated sludge components. Reeration of sewage and

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

oxygen application are discussed. Oxidation basins or ponds can utilize sludge removers, aeration equipment, and pond liners. Equipment for biological filters including trickling filters and rotating biological filters includes filter bed materials, drainage floors, and distributors. Manufacturers and suppliers are listed for most of the equipment discussed. (Small-FRC)  
W83-00325

#### ANAEROBIC DIGESTION OF FREE VOLATILE FATTY ACIDS IN SOILS BELOW WASTE TIPS,

Institute for Land and Water Management Research, Wageningen (The Netherlands).

J. Hoeks, and R. J. Borst.

Water, Air, and Soil Pollution, Vol 17, No 2, p 165-173, 1982. 5 Fig, 3 Tab, 11 Ref.

Descriptors: \*Leachates, \*Volatile acids, \*Fatty acids, Soil columns, Sanitary landfills, Soil types, Anaerobic digestion, Fermentation, Methane.

Complex organic compounds are fermented anaerobically during the acidification stage in the fermentation of a landfill, yielding free volatile fatty acids and other products. Since this acidification stage may last several years, much attention has been given to the behavior of the free volatile fatty acids leached to the soils below landfills. Soil column experiments were conducted to evaluate the effects of free volatile fatty acid concentration and soil type on the removal of these acids in soil by methane fermentation. These experiments demonstrated that removal of these acids by this process can be quite effective, especially in soils with a high buffering capacity, and that the maximum allowable concentrations of volatile fatty acids for methane fermentation in soils is much higher than previous studies indicated. The limiting concentration for a sandy loam soil, in which the retention time was only 17 days, exceeded 6,500 milligrams per liter of acetic acid equivalents. Methane fermentation was impeded in all soil types at about 25,000 milligrams per liter of acetic acid equivalents. In sandy soils with a low buffering capacity, the methane fermentation was already limited at rather low acid concentrations. When the pH of the leachate is buffered at between pH 6.5 and 7.0, methane fermentation can be very efficient, especially at the long soil retention times common for field conditions. In such cases, the volatile fatty acids will generally be completely removed from the leachate in the upper meter of soil. (Carroll-FRC)

W83-00326

#### THE INFLUENCE OF PROCESS PARAMETERS ON THE REMOVAL OF HEAVY METALS IN ACTIVATED SLUDGE,

Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.

A. C. Rossin, R. M. Sterritt, and J. N. Lester.

Water, Air, and Soil Pollution, Vol 17, No 2, p 185-198, 1982. 7 Fig, 5 Tab, 34 Ref.

Descriptors: \*Heavy metals, \*Activated sludge process, \*Wastewater treatment, Process efficiency, Performance evaluation, Biological treatment, Solubility, Cadmium, Copper, Nickel, Lead, Chromium, Zinc.

The effect of sludge age on metal removal efficiencies and metal uptake by the activated sludge biomass and the importance of heavy metal solubility and speciation in the behavior of heavy metals in the activated sludge process were investigated. The fates of normal and elevated influent concentrations of six heavy metals were studied in an activated sludge pilot plant. The addition of soluble heavy metal salts to settled sewage resulted in consistently higher percentage removals of heavy metals at sludge ages of 4, 9, and 12 days, possibly as a result of lesser variations in heavy metal speciation in the settled sewage. The greatest degree of accumulation of heavy metals by the biomass occurred at the 12 day sludge age. Effluent concentrations of heavy metals did not immediately rise in proportion to the introduction of shock loads of these metals into the system. Heavy metal removal efficiencies were found to be similar

under steady state conditions of normal and elevated influent metal concentrations. Cadmium, copper, and nickel were largely soluble in the effluent samples, but chromium, lead, and zinc were predominantly insoluble, indicating that particulate forms of these metals may escape removal in secondary sedimentation. The consistently poor removal of nickel in the activated sludge process was reflected in its high degree of solubility in the settled sewage and final effluent. The two most soluble metals, copper and nickel, appeared to be associated to a large extent with high molecular weight substances in the settled sewage and final effluent, possibly influencing their availability for uptake by the biomass. (Carroll-FRC)  
W83-00327

#### DAILY CHEMICAL VARIABILITY OF DOMESTIC SEPTIC TANK EFFLUENT,

Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.

B. R. Whelan, and Z. V. Titmanis.

Water, Air, and Soil Pollution, Vol 17, No 2, p 131-139, 1982. 1 Fig, 8 Tab, 14 Ref.

Descriptors: \*Chemical composition, \*Septic tanks, \*Domestic wastes, Trace metals, Nitrogen, Phosphorus, Chemical analysis, Conductivity, Oxidation-reduction potential, \*Australia, Fate of pollutants.

Although the use of septic tanks for the disposal of liquid domestic waste is very common in Australia, very little information on the composition of septic tank effluent in Australia has been published. Septic tank effluents from five households, representing a range of family situations, were sampled daily for 15 days. Measurements were made of temperature, redox potential, conductivity, and 5-day biochemical oxygen demand. Samples were analyzed for nitrogen, phosphorus, calcium, magnesium, sodium, potassium, copper, zinc, cadmium, chromium, lead, manganese, and linear alkylate sulfonate (LAS). While there were differences among the households with respect to the effluent composition, these differences were small. Values were most different for the household consisting of an elderly couple who diverted some of their waste waters to their garden. Little variation occurred in the effluent from any one household over the 15 days covered. The effluent was in a reduced and anaerobic condition, with almost all of the nitrogen and phosphorus occurring in the inorganic form in solution, placing a great dependence on the soil for reduction of these chemicals. The effluent contained about 100 milligrams of nitrogen per liter and about 15 milligrams of phosphorus per liter, giving a mean annual loading for the five households of about 3.8 kilograms of nitrogen per liter and about 15 milligrams of phosphorus per liter, giving a mean annual loading for the five households of about 3.8 kilograms of nitrogen and 0.6 kilograms of phosphorus per person per year. Copper and zinc, which were the only trace metals of any significance in the effluent, were less concentrated in the effluent than in the tap water from the households sampled. Comparisons with data from other countries showed that the chemical composition of the septic tank effluent was very similar to that found in New Zealand, Canada, and the United States. (Carroll-FRC)  
W83-00328

#### PRIMARY TREATMENT.

Public Works, Manual, p D18-D27, 1982.

Descriptors: \*Primary wastewater treatment, \*Screens, \*Sedimentation, \*Industrial wastewater, \*Suspended solids, Clarification, Clarifiers, Filtration, Filters, Settling basins, Flotation, Flocculation, Mechanical equipment, Wastewater treatment.

Primary wastewater treatment processes are discussed, including screening of large floating objects and sedimentation of grit. Screening techniques consist primarily of coarse screens, including automatic or manual rakes. Fine screens are useful in industrial wastewater treatment and include disc screen, drum screens, and vibrating

screens. Grit collection is implemented through the use of channel collectors and various types of washing collectors. Grit and screenings disposal equipment is also reviewed. After screening and grit removal, clarification equipment is usually used, including settling tanks, flotation, flocculation, and thickeners. Suppliers are listed for factory built sewage treatment units and components as well as for most of the equipment discussed. (Small-FRC)  
W83-00327

#### ADVANCED BIOLOGICAL TREATMENT TO ACHIEVE NUTRIENT REMOVAL,

Reedy Creek Utilities Co., Inc., Lake Buena Vista, FL.

C. R. Burdick, D. R. Relling, and H. D. Stensel. Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1078-1086, July, 1982. 7 Fig, 7 Tab, 23 Ref.

Descriptors: \*Advanced wastewater treatment, \*Nutrient removal, \*Biological wastewater treatment, \*Wastewater treatment, Bardenpho process, Nitrogen removal, Denitrification, Fermentation, Palmetto, \*Florida, Cost analysis, Phosphorus removal.

An advanced biological treatment system in Palmetto, Florida, uses the Bardenpho Process (BARD, DENitrification, PHOsphate), which removes N and P without addition of a chemical energy source for the microorganisms. It consists of a fermentation zone followed by a four-stage, complete-mix activated sludge process with alternating anoxic and aerobic conditions. Since January 1980, this plant has achieved 99% removal of BOD and suspended solids, 93.4% removal of total N, and 65-70% removal of total P. Average operating conditions are 1.22 mgd, 13.3 hours detention time, 164 mg per liter influent BOD, 143 mg per liter influent suspended solids, 32 mg per liter influent total N, and 8.4 mg per liter influent P. Initial construction costs were \$1,925,700 for the Bardenpho process and \$2,197,000 for the conventional process. Equivalent annual costs were \$289,014 and \$405,379 respectively. A Bardenpho process with design capacity of 1 mgd would cost 13% more than an extended aeration activated sludge system. (Cassar-FRC)  
W83-00349

#### MUNICIPAL PRETREATMENT PROGRAM DEVELOPMENT,

Brown and Caldwell, Walnut Creek, CA.

R. V. Cooley, R. M. Hunter, R. P. Sheridan, and J. J. Simmler.

Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1067-1077, July, 1982. 2 Fig, 7 Tab, 10 Ref.

Descriptors: \*Industrial wastewater, \*Planning, \*Monitoring, \*Wastewater treatment, Effluent standards, Effluent limitations, Regulations, Municipal wastewater, Legal aspects, Financing, Law enforcement, Public participation, Saline water.

The requirements and development of a publicly owned treatment works (POTW) pretreatment program are described. The POTW must have the legal authority to control changes in pollutant concentration or volume, require compliance with standards, carry out surveillance, and assess penalties for noncompliance. Procedures to ensure compliance must be available. Adequate finances, personnel, and equipment are needed to carry out the program. Elements of program development include an industrial inventory, establishment of pretreatment limitations, a monitoring enforcement program, arrangements with legal authorities, appropriate funding and information program to educate industry and the general public. Three case histories illustrate development of toxic limitations, control of operational problems, and analysis of control measures. Santa Cruz, California, established rational discharge limits by performing mass balances on the pretreatment works to determine allowable influent concentrations that satisfied effluent standards and did not exceed the plant's design limitations. Clark County, Nevada, developed a program to determine the contribution of

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

pollutants from all users, domestic and industrial, and evaluate several treatment options. Operational problems at Albany, Georgia, were solved after an industry monitoring program determined that two industries out of 44 were responsible for most of the problems. The Metropolitan Seattle, Washington, pretreatment program development was presented as an illustration of the entire planning process. (Cassar-FRC)  
W83-00350

### 5E. Ultimate Disposal Of Wastes

**CHARACTERIZATION OF PLUTONIUM IN GROUND WATER NEAR THE IDAHO CHEMICAL PROCESSING PLANT,**  
Geological Survey, Lakewood, CO.  
For primary bibliographic entry see Field 5B.  
W83-00019

**OBSERVATIONS ON THE BIOACCUMULATION POTENTIAL OF THORIUM AND URANIUM IN RAINBOW TROUT (SALMO GAIRDNERI),**  
Pacific Northwest Lab, Richland, WA. Dept. of Ecological Sciences.  
For primary bibliographic entry see Field 5C.  
W83-00021

**GEOHYDROLOGIC DESCRIPTIONS OF SELECTED SOLID-WASTE DISPOSAL SITES,**  
Geological Survey, San Juan, PR. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W83-00072

**WATER AND WASTE MANAGEMENT IN THE CANADIAN MEAT AND POULTRY PROCESSING INDUSTRY.**  
Stanley Associates Engineering Ltd, Edmo Edmonton (Alberta); and Dearborn Environmental Consulting Services, Mississauga (Ontario).  
For primary bibliographic entry see Field 3E.  
W83-00082

**SOLID WASTE MANAGEMENT IN SOUTH AFRICA,**  
National Inst. for Water Research, Pretoria (South Africa).  
For primary bibliographic entry see Field 5G.  
W83-00090

**HYDROGEOLOGY AND RESULTS OF INJECTION TESTS AT WASTE-INJECTION TEST SITES IN PINELLAS COUNTY, FLORIDA,**  
Geological Survey, Tallahassee, FL. Water Resources Div.  
For primary bibliographic entry see Field 5B.  
W83-00129

**SLUDGE DIGESTION AND DISPOSAL.**  
For primary bibliographic entry see Field 5D.  
W83-00152

**THE EFFECTS OF THE DISPOSAL OF SEWAGE EFFLUENTS ON GROUNDWATER QUALITY IN THE UNITED KINGDOM,**  
Water Research Centre (England).  
K. M. Baxter.  
Water Services, Vol 86, No 1035, p 219-220, May, 1982. 1 Fig, 2 Tab.

Descriptors: \*Land disposal, \*Groundwater pollution, \*Soil disposal fields, \*Wastewater disposal, Nitrification, Denitrification, Phosphorus, Groundwater recharge, Heavy metals, Water pollution sources, Bacteria, Organic matter, Dichlorobenzene, Phthalates, Alkenes, Steroids, \*United Kingdom.

The long-term effectiveness of the unsaturated and saturated zones in improving recharged effluent quality was investigated in Britain, along with the effect of effluent recharge on the aquifer itself. A

field study at nine sites studied temporal variations in natural and contaminated groundwater levels and water quality using wells and boreholes. Natural processes operating in the soil and in the unsaturated zone treated the effluent to a considerable degree, particularly in the removal of nitrogen, phosphorus, heavy metals, microbes, and soluble organic material. In the saturated zone, dilution by groundwater was the major treatment. Enteroviruses and pathogenic bacteria were all substantially removed during infiltration, and nitrification and denitrification did occur within unsaturated zones. Persistent compounds within groundwater were various trace-organics including dichlorobenzene, various phthalates, high boiling point alkenes, and steroids. (Small-FRC)  
W83-00220

**LAND APPLICATION OF MUNICIPAL SLUDGE WITH REGARD TO CROPPING SYSTEMS AND POLLUTION POTENTIAL,**  
Rutgers the State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies. A. J. Higgins, S. J. Toth, and M. E. Singley.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108399, Price codes: A04 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies, Report NJAES No R-03141-10-82, April 1982. 54 p, 27 Fig, 10 Tab, 2 Ref. OWRT A-057-NJ(1), 14-34-0001-1132.

Descriptors: \*Land disposal, \*Municipal wastes, \*Cultivate lands, \*Sludge disposal, \*Crop production, \*Application rates, \*Pollution, Sludge, Fertilizers, Solid wastes, Solid waste disposal, Waste disposal, Fertilization, Crop yield, Agriculture, Farming, Wastewater, Water quality standards, Trace elements, Heavy metals.

A study was undertaken to demonstrate the potential benefits in using sewage sludge as a soil conditioner/fertilizer on productive agricultural soils in New Jersey. Aerobically-digested liquid sewage sludge was applied to Sassafras sandy loam soil at rates of 0.22.4, and 44.8 metric tons/ha, in the spring of 1977, 1978, and 1979. Groundwater, soil, and crop contamination levels were monitored to determine the maximum sewage solids loading rate permissible without causing environmental deterioration. An application of 22.4 metric tons/ha (10 tons/acre) of East Windsor sludge was determined to be the upper limit for ensuring protection of groundwater quality, according to the Federal drinking water standard for nitrate nitrogen. Application rates between 11.2-16.7 metric tons/ha were found sufficient for providing plant nutrients for the dent corn and rye cropping system studied.

It must be recognized, however, that the use and disposal of sludge are two interdependent considerations of sludge management, and that both of these operations must be considered in specifying appropriate application rates. Of the trace heavy elements analyzed, iron and zinc levels (24 and 1.3 ppt, respectively) were the highest in the sludge. No heavy metals were sufficiently high to be detrimental to plant growth. Heavy metal levels are also determined in the crops and soil. (Zielinski-MAXIMA)  
W83-00236

**GEOLOGIC CRITERIA IN WASTE-MANAGEMENT SITE SELECTION IN NORTHEASTERN NORTH DAKOTA,**  
Alberta Research Council, Edmonton. Geology Div.

S. R. Moran, and B. M. Arndt.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108423, Price codes: A04 in paper copy, A01 in microfiche. North Dakota Water Resources Research Inst., Fargo, Completion Report, 1979. 46 p, 8 Fig, 41 Ref. OWRT A-040-NDAK(1), 14-34-0001-5034.

Descriptors: \*Waste management, \*Landfills, \*Site selection, \*Soil characteristics, \*Geologic mapping, \*North Dakota, Solid wastes, Waste disposal, Land disposal, Waste dumps, Sites, Contamination, Pollutants, Pollution load, Lagoons, Geological surveys, Waste storage, Waste assimilative capacity.

A review of existing geological mapping in eastern North Dakota (ND) and an evaluation of the various surface material characteristics as they influence suitability for sanitary landfill and stabilization-lagoon waste disposal were carried out. In the climatic setting of eastern ND, hydrologic confinement of liquid/solid waste can be best achieved by locating waste-management facilities in fine-grained and unfractured sediment (e.g., glacial till, lacustrine silt, or clay). Steep slope areas are best avoided due to the steeper hydraulic gradients encountered. Since discontinuities between different layers of till (marking former land surfaces) provide more permeable conduits for contaminant escape, the thickness of the surface till layer is important in waste management facility location. Where constructural relief on the surface layer of superglacial sediment that covers most of eastern ND is less than about 4 m, the base of a 5 m deep excavation is expected to encounter the surface layer base and permit contaminant escape. The evaluation principles of a proposed landfill/lagoon suitability are discussed. The results of this study, with existing geological mapping, will aid potentially suitable site selection requiring a minimum of engineering modifications and maintenance to acceptably confine wastes, and also assist evaluation of acceptability of currently proposed sites. (Zielinski-MAXIMA)  
W83-00236

**HIGH PH STABILIZATION OF WASTEWATER SLUDGE USING CHEMICAL SOFTENING WASTES FROM WATER TREATMENT,**  
Iowa Univ., Iowa City. Dept. of Civil Environmental Engineering.  
For primary bibliographic entry see Field 5D.  
W83-00243

**HAZARDOUS WASTE TECHNOLOGY TRANSFER ASSESSMENT.**  
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. C. A. Marro, and W. E. Sharpe.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108134, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, June, 1982. 68 p, 4 Append. OWRT C-00192-T(0496)(2), 14-34-0001-0496.

Descriptors: \*Technology transfer, \*Hazardous materials, \*Surveys, \*Land disposal, \*Waste disposal, Technology, Poisons, Toxins, Computer models, Leachates, Wastewater disposal, Public participation, Wastes, Waste management, Waste load, Groundwater pollution, Environmental protection.

An assessment was made of hazardous waste disposal technology transfer to determine the need for and suitability of information, and to identify people needing this information and the best means of providing it for their use. The scope of groundwater contamination is discussed, and disposal techniques and current regulations for groundwater protection are outlined. The information search strategy included a literature search, consultation with computerized information files, and contact with groundwater and waste disposal experts and with government agencies. Groups/individuals who may use disposal technology are identified and characterized, and user needs (technical information level, publication format) are discussed. Significant research and technology transfer products and their strengths and weaknesses are identified, including the agency/association/corporation sources for these products. Recommendations are made for three needed technology transfer products: a semi-technical report on a developed improved model for estimating dispersion coefficients; a non-technical report on permeability of liners used in land-fills; and public education packet presenting rational objective information on groundwater flow and contamination. Cost-benefit analyses are included where appropriate. (Zielinski-MAXIMA)  
W83-00276

**SPREADING LAGOONED SEWAGE SLUDGE ON FARMLAND: A CASE HISTORY,**

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Treatment and Quality Alteration—Group 5F

#### Purdue Univ., Lafayette, IN.

C. M. Robson, and L. E. Sommers.

Available from the National Technical Information Service, Springfield, VA 22161 as PB82-181082, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-82-019, May 1982. 3 p, 1 Tab. C2575NASX.

Descriptors: \*Cropland, \*Land disposal, \*Sludge disposal, \*Public relations, Corn, Soybeans, Cadmium, Polychlorinated biphenyls, Public opinion.

When the city of Indianapolis, Indiana, was required to construct advanced wastewater treatment facilities at the existing Belmont Wastewater Treatment Plant, it was determined that the most cost effective site was the 10 sludge lagoons containing 420,000 cu m of digested sewage sludge for up to 50 years. The major portion of the sludge (265,000 cu m) was disposed of by application to privately owned cropland in adjacent Boone County. Cadmium and polychlorinated biphenyl (PCB) contents of the sludge were the major constraints in determining the sludge application rates to the cropland. Frequent analyses of the sludge solids were needed to identify the appropriate rates. Landowners consigned about 5,000 ha for a single sludge application, after which corn and soybeans were grown. An effective public relations program minimized public resistance and secured the cooperation of area residents. Analysis revealed no measurable increases in the Cd and PCB contents of the grain after the single sludge application. Techniques were developed for removing, transporting, and applying lagooned sludges and for administering and monitoring such a program. (Moore-SRC)  
W83-00296

#### SLUDGE DISPOSAL FROM ACID MINE DRAINAGE TREATMENT,

Bureau of Mines, Pittsburgh, PA. Pittsburgh Research Center.

T. E. Ackman.

Bureau of Mines Report of Investigations RI 8672, 1982. 28 p, 7 Fig, 8 Tab, 6 Ref, 1 Append.

Descriptors: \*Sludge disposal, \*Acid mine drainage, \*Wastewater treatment, \*Coal mines, Mine wastes, Industrial wastewater, Underground waste disposal, Land disposal, Land reclamation, \*Pennsylvania, \*Treatment facilities.

Acid mine drainage (AMD) treatment plants (33), operated by 11 Pennsylvania coal companies, were randomly surveyed for information on sludge volume, sludge settling, transportation and disposal. Of the 33 treatment plants, 6 treated water from abandoned workings, 7 treated water from mines scheduled to close within the next 5 years, 4 treated water from mines scheduled to close within 5 to 10 years, 7 treated water from mines scheduled to close within 10 to 20 years, and 9 treated water from mines scheduled to close after that. Onsite visits allowed observation of problems associated with the various methods of sludge disposal: disposal into a deep mine; permanent retention in ponds; disposal at an active coal refuse area; and onsite burial. Deep mine disposal is the most frequently used method and the most environmentally sound. It is apparent that the magnitude of sludge production is such that an aggressive and directed effort in reduction of sludge volume is seriously needed. The areas of major concern are the amount of surface land required for sludge storage and disposal, reclamation of these disturbed surface areas, and effective and efficient means of removing, transporting, and disposing of AMD sludge. Better water-handling procedures, to prevent acidification of mine waters, must be developed and universally applied. Where an irreducible volume of water must be treated, treatment should be such as to provide a dense, easily handled, and readily disposable sludge. (Moore-SRC)  
W83-00298

#### WATER QUALITY CRITERIA AND EFFLUENT REQUIREMENTS IN BROWARD COUNTY, FLORIDA,

Montgomery (James M.), Inc., Pasadena, CA. For primary bibliographic entry see Field 5G. W83-00320

#### ANAEROBIC DIGESTION OF FREE VOLATILE FATTY ACIDS IN SOILS BELOW WASTE TIPS,

Institute for Land and Water Management Research, Wageningen (The Netherlands). For primary bibliographic entry see Field 5D. W83-00326

### 5F. Water Treatment and Quality Alteration

#### THE WATER SUPPLY OF THE BRUSSELS URBAN AREA AND ITS SURROUNDINGS.

Aqua, No 3, p 18-19, 21, 23, 27, 1982. 6 Fig.

Descriptors: \*Water supply, \*Municipal water, \*Water storage, \*Brussels, \*Belgium, \*Water treatment, Water distribution, Water transport, Reservoirs, Groundwater storage, Water quality control, Potable water, Drinking water.

The water treatment and distribution system of the Brussels, Belgium, urban area serves over 2 million inhabitants with an average of 310,000 cu m of water per day. Since 1973 water from the River Meuse has been added to the groundwater supplies, which include underground sand draining galleries, catchments in the limestone hills, water from an abandoned pyrite mine, water in unused quarries, and wells. The surface water treatment plant at Taiter uses filtration, sulfuric acid for pH correction, chlorination, chlorine dioxide to decompose humic matter, alum, activated silica, activated carbon, caustic soda pH correction, settling, filtration in finely ground flint, and ozonation. This process is described in detail. The water supply system includes a computer-controlled central dispatching system, seven distribution networks and modern water quality control. (Cassar-FRC)  
W83-00020

#### CHEMICAL STABILITY OF WATER.

Pretoria, South Africa, National Inst. for Water Research, Pretoria (South Africa).

Information Sheet I-WAT-10, February 1980. 3 p.

Descriptors: \*Scaling, Water properties, \*Corrosion control, \*Water conveyance, \*Chemical treatment, Chemical degradation, Chemical properties, Corrosion, Boreholes, Water quality control, Deterioration, Fouling, Metal pipes, Plastic pipes, Water distribution, Heated water, Water purification, Inhibitors, \*Water treatment.

Stability problems, their causes and prevention, and methods for stability determination and control are briefly reviewed. Water which is chemically stable is generally neither corrosive nor scale-forming. Water stability depends on its pH, alkalinity, temperature, hardness, and the concentration and nature of its dissolved constituents (total dissolved solids). Problems caused by corrosion and scale formation often occur in distribution systems, such as in corrosion in pipes and scaling in hot water systems. Stability control in distribution systems is, hence, of crucial importance. It was concluded that, under normal conditions, the stability of water for domestic use can be controlled to a reasonable degree, and that scaling in hot water systems and corrosion of metal parts can be reduced but not wholly eliminated. Treatment of corrosive borehole (BH) water involves pumping and transportation using plastic components/pipes and contact with a column of calcium carbonate; treatments of scale-forming BH water can involve ion-exchange, lime softening, or the use of chemical inhibitors. Factors contributing to corrosion (anionic/cationic corrosivity ratio, dissolved gases, use of metal devices/pipes for water purification/transportation) and its prevention are considered. (Zielinski-MAXIMA)  
W83-00091

#### DESIGN AND CONSTRUCTION OF THE PENNICHUCK WATER TREATMENT PLANT: THE ENGINEER'S VIEW,

Anderson-Nichols and Co., Inc., Boston, MA.

L. W. Long.

Journal of the New England Water Works Association, Vol 96, No 2, p 97-99, 1982.

Descriptors: \*Construction, \*Cost analysis, \*Water treatment facilities, Design criteria, Water treatment, Pennichuck Water Works, Nashua, \*New Hampshire, Economic aspects.

Steps in design and construction of the Pennichuck Water Works plant, New Hampshire, began with cost analysis. Preliminary planning involved pre-selected major process equipment components. After site subsurface explorations had been completed, scale plans and sections were prepared and submitted for criticism and revision. Disposal of backwash water and sludge was not resolved immediately. For a 5-year period this material is being sent to the municipal wastewater plant. Several cost saving innovations emerged through the project, for example, locating the plant to take advantage of gravity flow. (Cassar-FRC)  
W83-00135

#### DESIGN AND CONSTRUCTION OF THE PENNICHUCK WATER TREATMENT PLANT: THE CONSTRUCTION MANAGER'S VIEW,

White (R. H.) Construction Co., Inc., Auburn, MA.

R. T. Koopman.

Journal of the New England Water Works Association, Vol 96, No 2, p 100-103, 1982.

Descriptors: \*Construction, \*Contracts, \*Water treatment facilities, Design criteria, Water treatment, Pennichuck Water Works, Nashua, \*New Hampshire, Cost analysis, Critical path analysis, Planning, Management.

A construction management contract was drawn up for construction of the Pennichuck Water Works plant, serving Nashua, New Hampshire. The team consisted of the owner, engineer (consulting engineer plus process manufacturer), and construction manager. A guaranteed maximum price contract for \$7 million was negotiated between the construction company and the owner. The most critical part of the job was getting the structure closed before winter so that work could proceed inside. A Critical Path Method was vital as a flexible guide. Advantages of this contract arrangement include good communications, freedom of expression, and use of value engineering. (Cassar-FRC)  
W83-00136

#### NEW EPA SODIUM AND CORROSION REGULATIONS: THEIR BASIS AND IMPACTS,

Camp, Dresser, and McKee, Inc., Boston, MA.

For primary bibliographic entry see Field 5G.

W83-00137

#### DEVELOPING AND APPLYING INTERNATIONAL WATER QUALITY GUIDELINES,

Pan American Health Organization, Washington, DC.

For primary bibliographic entry see Field 5G.

W83-00167

#### RAPID-MIX DESIGN FOR MECHANISMS OF ALUM COAGULATION,

Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.

A. Amirtharajah, and K. M. Mills. Journal of the American Water Works Association, Vol 74, No 4, p 210-216, April, 1982. 11 Fig, 29 Ref.

Descriptors: \*Alum, \*Chemical coagulation, \*Water treatment, Mixing, Design criteria, Process efficiency, Performance evaluation.

The rapid-mix unit provides the hardware necessary for the initial stages of the alum coagulation process in water treatment facilities. Information

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5F—Water Treatment and Quality Alteration

on the basic hydrodynamic parameters, geometry, and molecular structure of the water to be treated and on the kinetics of the chemical processes that occur can be used to improve the design of rapid mixers. Recent work has made it possible to generalize zones of slow coagulation, rapid coagulation, no coagulation, and resuspension on the stability diagram for alum coagulation. This study investigated the type of rapid mixing necessary to specific regions of the stability diagram to facilitate the tailoring of the design of rapid mix operations to the predominant mode of alum coagulation. The diagram for alum stability and coagulation was used to predict specific alum doses and pH where optimum coagulation would occur. A design and operation diagram for practical use in predicting and analyzing optimum conditions for alum coagulation was then developed which tailors the design of the rapid mix unit to the predominant mode of alum coagulation. High-intensity mixing made a significant difference in the adsorption-desaturation zones, but not in the zone where sweep coagulation dominates. A back mix reactor or a blender was adequate for most conditions. (Carroll-FRC) W83-00170

#### ADSORPTION OF TOXIC AND CARCINOGENIC COMPOUNDS FROM WATER, Michigan Univ., Ann Arbor. Dept. of Environment and Water Resources Engineering.

W. J. Weber, Jr., and M. Pirbazari.

Journal of the American Water Works Association, Vol 74, No 4, p 203-209, April, 1982. 15 Fig, 3 Tab, 31 Ref.

Descriptors: \*Water treatment, \*Activated carbon, \*Carcinogens, \*Toxins, Adsorption, Mathematical models, Simulation analysis, Performance evaluation, Trace levels, Organic compounds, Water reuse, Agricultural chemicals, Wastewater renovation.

Successive reuse of water in many areas has led to the accumulation of persistent toxic and carcinogenic organic compounds of industrial or agricultural origin in many water sources and supplies, frequently at levels that pose health hazards. Granular activated carbon treatment can remove many of these compounds. However, efficient, cost effective applications of this technique require the establishment of rigorous data bases that characterize specific system dynamics. Information from these data bases must then be incorporated into plant design and operation. The Michigan Adsorption Design and Application Model is being used for data synthesis and for simulation and prediction of the performance of carbon beds in removing trace quantities of specific toxic or carcinogenic compounds under conditions approximating water treatment practice. This model has been applied to evaluation of the adsorption characteristics of benzene, p-dichlorobenzene, carbon tetrachloride, dielein, and two polychlorinated biphenyls. Experimental fixed-bed adsorber studies were designed to investigate dynamic adsorption behavior and to obtain data for simulation and predictive modeling of the breakthrough characteristics of each of the compounds. Reasonable agreement was demonstrated between experimental fixed-bed adsorber behavior and model predictions of breakthrough profiles for benzene, carbon tetrachloride, and p-dichlorobenzene, but not for the two polychlorinated biphenyls. No significant breakthrough was achieved with the dielein. (Carroll-FRC) W83-00171

#### REMOVING SOLUBLE ORGANIC CONTAMINANTS BY LIME-SOFTENING, Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

S. J. Randtke, C. E. Thiel, M. Y. Liao, and C. N. Yamaya.

Journal of the American Water Works Association, Vol 74, No 4, p 192-202, April, 1982. 14 Fig, 14 Tab, 61 Ref.

Descriptors: \*Organic matter, \*Solutes, \*Water treatment, \*Wastewater treatment, Chemical treatment, Lime, Water softening, Fulvic acids, Humic acids, Drinking water.

Although lime-soda softening is frequently used in the treatment of municipal and industrial water supplies and the treatment of wastewaters to remove a variety of pollutants, its potential for removing organic matter from water has not been explored adequately and it has not been used primarily for the removal of soluble organic contaminants from water. The potential of lime-soda softening to remove specific chemical contaminants was investigated under a variety of operational and chemical conditions. These contaminants included a fulvic acid extracted from peat, a fulvic acid extracted from groundwater, and a commercially available humic acid. Treatment with lime-soda softening effectively removed several humic substances from solution. Removal increased with increasing pH, with increasing amounts of precipitate, and with decreasing concentration of total organic carbon. The presence of magnesium or phosphate significantly enhanced removal, particularly when a small amount of precipitate was formed. Several soluble organic chemicals were at least partially removed from true solution by the treatment, although some were not removed to any significant extent. High residual calcium concentrations and waterite formation resulted from soda-induced precipitation in batch systems, and total organic carbon removals were only slightly greater than those achieved with lime-induced precipitation. Calcium ion caused the precipitation of several organic substances at elevated pH in the absence of carbonate ion, indicating that precipitation is a potential removal mechanism. Calcium, carbonate, phosphate, and magnesium ions all influenced the removal of peat fulvic acid by lime-soda softening, suggesting that adsorption may be a major removal mechanism. (Carroll-FRC) W83-00172

#### WEST RIVER GETS INNOVATIVE TECHNOLOGY, New Haven Water Co., CT.

R. McHugh, and K. W. Henderson.

Water/Engineering and Management, Vol 129, No 8, p 47-48, July, 1982.

Descriptors: \*Filtration, \*Drinking water, \*Water treatment, Automation, Potable water, Water quality, Water treatment facilities, Connecticut.

The first direct filtration plant in Connecticut was built by the New Haven Water Company near Woodbridge. Fully automated, the West River plant treats water with potassium permanganate and caustic soda if necessary, coagulation (cationic polymer with or without alum) in the flash mixing, and filtration through four 600 sq ft filters. Filter backwash water is discharged to two 800,000 gal lagoons. Filtered and fluoridated water enters two 3 million gal ground level storage reservoirs prior to entering the distribution system. The plant requires only one 8-hour shift of 2 persons each day with personnel on call to answer alarms during the unmanned periods. (Cassar-FRC) W83-00197

#### NEW TECHNOLOGY FOR DRINKING WATER TREATMENT, Illinois Univ. at Urbana-Champaign. Dept. of Environmental Engineering.

S. J. Randtke.

Water/Engineering and Management, Vol 129, No 8, p 38-40, 42, 44, July, 1982. 3 Fig, 2 Tab, 8 Ref. W83-00198

Descriptors: \*Activated carbon, \*Filtration, \*Water treatment, Adsorption, Direct filtration, Organic compounds, Magnesium carbonate, Ozonation, Biological treatment, Ion exchange resins, Resins, Drinking water, Ammonia, Oxidation, Potable water.

New developments in drinking water treatment technology have been affected by cost and energy constraints, the public pressure for potable and palatable water, environmental regulations, and conservatism in engineering and regulatory fields. Examples of treatments resulting from these influences are direct filtration, activated carbon adsorption, ozone plus granular activated carbon, biologically enhanced activated carbon adsorption, ion exchange and adsorbent resins, and the magnesium

carbonate process. Each process has advantages and disadvantages and is effective in treating certain impurities. Direct filtration works best with waters of low turbidity. Activated carbon removes most taste and odor problems and many synthetic organic chemicals. Ozonation prior to granular activated carbon adsorption improves taste and odor, oxidizes Fe and Mn, disinfects, improves ammonia removal by promoting growth of nitrifying bacteria, and greatly reduces formation of trihalomethanes. Biologically enhanced activated carbon adsorption extends the life of activated carbon beds and improves efficiency by removing biodegradable but nonadsorbable compounds. Synthetic resins are presently in the laboratory and pilot stage of investigation; however, they may be very useful in specialized applications. Magnesium carbonate-lime treatment reduces chemical costs and allows recovery of CaCO<sub>3</sub> from sludge so it may be recycled or sold. (Cassar-FRC) W83-00198

#### CONTROL MEASURES FOR GROUNDWATER VOCs, Pirnie (Malcolm), Inc., White Plains, NY.

G. P. Westerhoff, and V. W. Uhl, Jr.

Water/Engineering and Management, Vol 129, No 8, p 30-33, July, 1982. 4 Fig, 7 Ref.

Descriptors: \*Organic compounds, \*Groundwater pollution, Water treatment, \*Volatile organic compounds, Chlorinated hydrocarbons, Solvents, Wells, Adsorption, Water pollution prevention, Water pollution treatment, Water pollution sources, Water quality control, Cost analysis, Plumes, Aeration, Activated carbon.

Many options exist for prevention or treatment of volatile organic compounds (VOC) in groundwater. These compounds, typified by trichloroethylene and tetrachloroethylene, have been found in 45% of the public water systems serving over 10,000 people and 12% of smaller systems which use groundwater. Control at the source prevents contamination from reaching the water supply. This may be accomplished by eliminating the source of the VOC, blending contaminated water with cleaner water to achieve acceptable levels, controlling plume migration by pumping selected wells to waste, and installing interceptor/recovery wells to control plume migration. VOCs in a drinking water supply may be most cost-effectively treated by aeration or granular activated carbon adsorption or a combination of both. Two types of aeration equipment are available: diffused (bubbles of air passed upwards through the water) and waterfall (cascades, multiple trays, spray nozzles, or countercurrent packed columns). Each has advantages and disadvantages. The choice of a suitable process depends on the solubility of the chemical and its affinity for activated carbon. Saturated compounds are less easily adsorbed on activated carbon than unsaturated compounds. In designing a treatment system the following should be considered: on-site carbon regeneration of less than 2000 lb per day is uneconomical, several organic chemicals may be present simultaneously, and site conditions are variable. (Cassar-FRC) W83-00199

#### HYDRODYNAMICS AND FOULING OF PRESSURE DRIVEN MEMBRANE DESALINATION AND WATER TREATMENT SYSTEMS, Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

For primary bibliographic entry see Field 3A. W83-00244

#### AN EVALUATION OF THE RECOVERY OF ADIRONDACK ACID LAKES BY CHEMICAL MANIPULATION, Clarkson Coll. of Technology, Potsdam, NY.

Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 5G. W83-00245

#### ALGAE REMOVAL BY INDUCED AIR FLOTA-TION, Louisiana Water Resources Research Inst., Baton Rouge.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Treatment and Quality Alteration—Group 5F

For primary bibliographic entry see Field 5G.  
W83-00277

#### WATER TREATMENT FOR SMALL PUBLIC SUPPLIES,

New Mexico State Univ., Las Cruces. Dept. of Chemical Engineering.

D. B. Wilson, and R. M. Duran.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108175, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute, Report No 141, New Mexico State University, Las Cruces, February, 1982. 93 p, 13 Fig, 45 Tab, 31 Ref, 8 Append. OWRT T-0009-NMEX(7515)(4), 14-34-0001-7515.

Descriptors: \*Reverse osmosis, \*Electrodialysis, \*Drinking water, \*Water treatment, \*Water supply, Ion exchange, Engineering, Design criteria, Spectrophotometry, Estimated costs, Small watersheds, \*New Mexico, Water supply development, Water supply systems, Potential water supply, Chemical precipitation, Water demand, Membrane processes, Water quality standards.

Reverse osmosis (RO) and electrodialysis (ED) were shown to be successful methods for upgrading current drinking water supplies for small New Mexico communities to meet drinking water standards. A mobile demonstration unit was operated 500-2000 hours in each of nine communities visited, using feed from the current drinking water supply. In all cases, product water from the demonstration unit (as certified by the appropriate agency) met drinking water standards. Engineering design data are presented for the evaluation of ED, RO, and ion-exchange unit operations for application in the drinking water systems. The potential for selective removal of ionized cationic contaminants by precipitation as their sulfides was also assessed (for cadmium, mercury, and zinc), using a developed stopped-flow spectrophotometry technique. Preliminary data indicated the appropriateness of sulfide precipitation under special conditions (e.g., low total dissolved solids, high concentrations of only 1-2 of the cations). Application of this technique to the removal of fluoride as calcium fluoride required a large excess of calcium for reasonable precipitation/sedimentation rates; any effect of the added calcium on drinking water quality should be considered. (Zielinski-MAXIMA)  
W83-00280

#### BLACKHEATH WATER TREATMENT PLANT, City Engineering Dept., Cape Town, South Africa.

J. G. Brand.

Imiesa (Johannesburg), Vol 6, No 1, p 28-29, 31, 33, December-January 1980/81.

Descriptors: \*Water treatment, \*Water treatment facilities, \*Water supply, \*Design criteria, \*Reservoir storage, Wastewater facilities, Chlorination, Water demand, Water supply systems, Water quality, Water quality management, Civil engineering, Sanitary engineering, Evaluation, \*South Africa, Water storage.

The Rivieronderend/Berg/Eerste Rivers water augmentation scheme, promoted by the South Africa Department of Water Affairs to exploit the Rivieronderend, brings under control five different catchments (Upper Berg, Upper Rivieronderend, Banhoek, Eerste, and Wolwefloof Rivers). The City of Cape Town's responsibilities in this scheme includes the water treatment plant, currently under construction at Blackheath for water supply of the greater Cape Town area. Details of the treatment process and plant design are presented. In the treatment process, alum, lime, and sodium aluminate are mixed with influent water; this is followed by conditioning and settling tanks (removal of floc particles), passage through two banks of 20 filter beds each with 1-meter fine sand in the bottom, addition of lime and carbon dioxide for water stabilization, addition of chlorine for sterilization, and transfer to a storage reservoir. Engineering design specifics and operation of this process (which was technologically proven at alternate installations) are delineated and illustrated.

The remaining major unit of the City of Cape Town's responsibility in the scheme will be a 550 mega-liter service reservoir planned for construction near the water treatment plant. Supplies from this scheme are expected to meet urban water demands in the Western Cape until 1987-88; planning is now underway for the next augmentation project to meet water needs thereafter. (Zielinski-MAXIMA)  
W83-00283

#### INCREASING ARCAT TEST SENSITIVITY FOR EXAMINATION OF POTABLE WATERS, Atlantic Research Corp., Alexandria, VA.

J. D. Isbister, J. L. Alm, R. Foutch, A. DeSouza, and R. S. Wentzel.

Available from the National Technical Information Service, Springfield, VA 22161 as PB82-196163, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-82-025, May 1982. 5 p, 1 Fig, 3 Tabs. 68-03-2914.

Descriptors: \*Coliforms, \*Coliphages, \*Water analysis, \*Disinfection, \*Water treatment, Bacterial analysis, Membrane filters, Potable water, Chlorine dioxide, Ozone, Fecal coliforms, Water quality.

A method for concentrating coliphages from potable waters was developed to be used in conjunction with a rapid coliphage analysis technique (ARCAT) to detect 1 coliphage/100 ml of water sample. Membrane filtration with the use of positively charged filters is the concentration method of choice. Positively charged filters can be used successfully to concentrate coliphages present in potable water at a level of 1 plaque forming unit (pfu)/100 ml of water sample using the ARCAT procedure. The ARCAT amplification technique can be used to obtain qualitative indication of the presence of coliphage when coliphage numbers are expected to be less than 5/100 ml and can be run in parallel with the ARCAT/concentration procedure. Test results are available in 6.5 hours at an approximate cost of \$4.12 per test. ARCAT results can be used to estimate the number of fecal and total coliforms in the water sample or may be used independently as an indicator of water quality. Examination of the effects of physical treatment of water indicated that settling and filtration are effective means for reducing levels of coliphages and total and fecal coliforms in natural waters. Coliphages appeared to be less efficiently removed by these processes than total and fecal coliforms. Disinfection studies indicated that chlorine dioxide was effective as a viricide and bactericide. At ozone levels achieved in this study, reductions in coliphages and coliforms were not consistent. Ozone disinfection effectiveness was both concentration and exposure-time dependent. (Moore-SRC)  
W83-00293

#### INSTRUMENTAL METHODS OF MONITORING AND CONTROL OF WATER AND WASTEWATER TREATMENT PROCESSES, Taylor (John) and Sons, London (England).

R. Briggs.

ISA Transactions, Vol 21, No 2, p 59-73, 1982. 6 Tab, 49 Ref.

Descriptors: \*Automation, \*Water treatment, \*Wastewater treatment, \*Water distribution, United Kingdom, U.S.A., Computers, Control systems, Monitoring, Sensors, Remote sensing, Management planning, Water pollution control, Pollutant identification, Manpower.

The role of instrumentation and control for cost-effective management of water courses and water and wastewater treatment facilities is discussed. In the United Kingdom (U.K.) emphasis will probably be placed on control instrumentation used to maintain quality standards for potable waters and effluents with lower energy consumption and manpower. It is likely that the market for specialized sensors to monitor specific organics and toxic metals will increase. Monitoring of water upstream of intakes to ensure the effectiveness of wastewater treatment plants and to protect against the effects

of accidental spills entering the intake will also increase. Existing sensors include those that monitor and control flow, dissolved oxygen, organic and suspended matter, hardness, and pH value. Recent sensor developments include one based on coulometry using two platinum electrodes and a pulsed differential anodic-stripping voltammeter with a hanging mercury drop electrode for monitoring metals; research into the use of polymers, phthalocyanines, and other organic films to measure volatile organics in the head space; and devices to detect oil and toxicity (especially biological techniques). Computers can be used to detect sensor failure, for example by comparing values transmitted by the sensor with previous values in the computer's memory. Instrumentation applications in the U.K., and U.S.A., Europe, and Japan are described. Two telecontrol systems for water distribution are in use in the U.K., and about 100 automated central control stations exist in the U.S.A. In water treatment, recent developments in the U.K. will probably lead to the use of feed-forward control systems, whereas in the U.S.A. most installations are supervisory and devoted to monitoring local analog loops with alarms. For wastewater treatment, developments in the U.S.A. have been in the area of computer control directed toward plants serving large populations, while those in the U.K. have mainly been aimed at monitoring as a management aid. (Gish-FRC)  
W83-00314

#### WATER SUPPLY AND TREATMENT, SECTION C-1, RAW WATER PREPARATION, Public Works, Manual, p C2-C10, 1982.

Descriptors: \*Drinking water, \*Sedimentation, \*Screens, \*Intakes, \*Suspended solids, Orifices, Chemical treatment, Chemical coagulation, Flocculation, \*Water treatment, Clarification, Sedimentation basins.

The treatment of raw water for human consumption and industrial needs is discussed, and equipment for water preparation is described. Specific products are mentioned, including types of intakes and screens, coagulating chemicals, and sedimentation tanks. Coarse screens, fine screens, microstraining, and automatically operated screens are discussed for concentrating impurities in raw water. Removal of finely suspended materials is considered in a discussion of coagulating chemicals, proper handling of chemicals, and mixing and flocculation equipment. Sediment and coagulated floc can be removed using horizontal flow sedimentation tanks, upward flow tanks, and tube-type clarifiers. Sources for package plants are also listed. (Small-FRC)  
W83-00335

#### DISINFECTION, TASTE AND ODOR CONTROL, Public Works, Manual, p C21-C26, 1982.

Descriptors: \*Drinking water, \*Disinfection, \*Odor control, \*Taste, \*Chlorination, Chemical treatment, Ammonia, Ozone, Ozonation, Mechanical equipment, Adsorption, Activated carbon, Potassium compounds, Copper sulfate, Odor-producing algae, Algal control, Water treatment, Aeration, Hydrogen sulfide.

Methods and equipment for the disinfection of drinking water and taste and odor control are reviewed. Disinfection chemicals include chlorine, calcium hypochlorite, and ammonia, and water supplies can also be disinfected using ozonation. Chlorinators, which meter chlorine gas, hypochlorinators, ammoniators, chlorine evaporators, and dechlorinators are described. Taste and odor control are made possible through adsorption using substances such as activated carbon, chemical oxidation using potassium permanganate or ozone, and algae control using copper sulfate. Aeration and deaeration are used to remove taste and odor, and degassers are used to remove entrained gases such as hydrogen sulfide. Sources are listed for most of the equipment discussed. (Small-FRC)  
W83-00341

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5F—Water Treatment and Quality Alteration

#### SOFTENING, IRON AND MANGANESE REMOVAL

Public Works, Manual, p C15-C21, 1982.

Descriptors: \*Drinking water, \*Water softening, \*Iron, \*Manganese, \*Fluorides, Ion exchange, Electrolysis, Reverse osmosis, Oxidation, Fluoridation, Water treatment, Zeolite process, Chemical treatment, Mechanical equipment.

Removing mineral impurities from public water sources is discussed, including water softening and iron and manganese removal. Legislation limiting mineral concentrations is reviewed. The lime-soda process, stabilizing softened water, disposal of process sludge, zeolite softening, and ion exchangers are aspects of softening. Desalting techniques for the removal of dissolved impurities other than calcium, magnesium, iron, manganese, or fluorides include ion exchange, electrolysis, and reverse osmosis. Iron and manganese are removed using oxidation or zeolite treatment. Fluoride adjustment methods and equipment include removal by activated alumina and addition by solution feeders. Sources of equipment and chemicals are listed for each topic discussed. (Small-FRC) W83-00342

#### 5G. Water Quality Control

##### TRADE EFFLUENT CONTROL AND THE MICROPROCESSOR

Anglian Water Authority (England). Lincoln Sewage Div.

J. J. Sweeney.

Water & Waste Treatment, Vol 25, No 5, p 40-42, May, 1982.

Descriptors: \*Data processing, \*Effluent charges, \*Industrial wastewater, \*Wastewater management, Wastewater treatment, Computer programs, Automation, Effluent limitations, Computers, Data storage and retrieval, Microprocessors.

In recent years, Trade Effluent Officers (TEO) have been expected to assess the degree of variation in effluent quality of each discharge and be able to predict the financial effect of any variation in sampling frequency. The TEO should also maintain close contact with trade industries and with other departments in his own treatment plant. To keep accurate trade effluent accounts, a microprocessor with an associated printer is also helpful. Microprocessors can provide a detailed breakdown of the quantity and quality of trade effluent discharged to a particular sewage treatment works. To set up a microprocessor system, the computer programmer must be given as much information as possible. Accurate records should be kept of the way a program is written. The disc based system of the Lincoln Sewage Division of the Anglian Water Authority is described. Discs are sometimes stored at a different location so that information is not totally lost should an accident occur. All the water authorities could use similar trade effluent computer systems if the modified Mogden formula were implemented. If microprocessors were to be fully utilized, the TEO's time would be freed to play a more active part in the management of the treatment plant. (Geiger-FRC) W83-00003

##### THE NATION'S WATER

For primary bibliographic entry see Field 6D. W83-00004

##### CORRELATION OF ROTIFER ASSOCIATIONS IN A CHAIN OF LAKES FED BY RECLAIMED SEWAGE

Concordia Univ., Montreal (Quebec).

T. Nogrady.

Hydrobiologia, Vol 89, No 3, p 277-284, May, 1982. 3 Fig, 4 Tab, 8 Ref.

Descriptors: \*Water pollution effects, \*Rotifers, \*Species diversity, \*Reclaimed water, \*Artificial lakes, \*Wastewater renovation, Aquatic animals, Species composition, Population density, Lakes, Water reuse, Wastewater management, Population dynamics, \*California.

As part of the Padre Dam Municipal Water District reclamation project, a preliminary study was made of the quantitative composition of the rotifer fauna of seven interconnected lakes of southern California. The lakes are fed by reclaimed sewage. The water quality increases dramatically from the first lake, which is barely able to support life, to a cluster of lakes supporting fish and varied recreational uses. This gradual improvement in water quality paralleled an increased rotifer population density in the better quality lakes, according to the Shannon index. From 24 to 28 different rotifer taxa were identified in each lake. Dominant communities were made up of Brachionids, Keratella, and Trichocerca. In the last lake, the only lake receiving reclaimed sewage from the percolation channel, the diversity and quantity of the rotifer association again declined. Use of the Bray and Curtis index of similarity and cluster analysis showed a biotic development with a maximum curve and a lake-chain evolution. (Geiger-FRC) W83-00023

##### DISSOLVED ORGANIC CARBON AND UV-ABSORPTION IN A POLLUTED LOWLAND BROOK-POND SYSTEM

Antwerp Univ., Wilrijk (Belgium).

L. Maes.

Hydrobiologia, Vol 89, No 3, p 269-276, May, 1982. 3 Fig, 4 Tab, 16 Ref.

Descriptors: \*Water treatment, \*Aeration, \*Ponds, \*Spectral analysis, \*Organic carbon, Water pollution treatment, Water pollution prevention, Organic wastes, Water pollution control, Dissolved solids, Suspended solids, Absorption, Monitoring, Organic matter, \*Belgium, Antwerp.

In Antwerp, Belgium a lowland brook-pond system that was polluted with organic wastes was aerated by the Phallus technique, involving a water jet vacuum pump. The brook-pond system has a difference in height between inflowing and outflowing water of about 4.3 m, and covers a stretch of 1500 m overall, in a number of successive brook-sections and ponds. The system is fed by two lowland brooklets supplying wastewater (domestic sewage). Over the course of a year the discharge strongly fluctuates, primarily due to the influence of precipitation. Usual inflow varies from 100 to 250 cu m/day, but the range has been from 10 to 500 cu m/day. The evolution of the organic carbon concentration and the UV-absorption was monitored from June 1974 to September 1976 at 12 sampling stations along the brook-pond system. Aeration caused an abrupt decrease in the organic carbon concentration in the immediate vicinity of the experimental station and a more gradual decrease at the downstream sampling sites. In general, changes in the concentrations of dissolved organic matter in natural waters are reflected in UV-absorption changes. From physico-chemical measurements such as turbidity, chemical oxygen demand and organic nitrogen, it appeared that changes brought about by aeration were more readily observed in the suspended than in the dissolved fractions. It was concluded that UV-absorption measurements serve as a simple and reliable method for determining the general trends occurring during water purification. (Geiger-FRC) W83-00024

##### GUIDELINES FOR SURFACE WATER QUALITY: VOL 1: INORGANIC CHEMICAL SUBSTANCES: COPPER

Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.

A. Demayo, and M. C. Taylor.

Report, 1981. 55 p, 5 Tab, 383 Ref.

Descriptors: \*Copper, \*Literature reviews, \*Water quality standards, \*Water pollution effects, Water quality control, Toxicity, Poisons, Trace elements, Heavy metals, Aquatic life, Livestock, Water pollution control, Surface water, Runoff, Ion transport.

Information is summarized for an extensive literature survey, carried out on the toxic effects of copper (Cu) and Cu compounds on human health, aquatic life, plants, and livestock. Considering that

the requirements of human metabolism are satisfied by a normal diet, that prolonged ingestion of larger Cu does not exceed 0.5 mg/liter of Cu, it is recommended that the Canada maximum Cu concentration in raw public water supplies should not exceed 0.5 mg/liter as total Cu. For lakes/streams, are related to aquatic life and wildlife, the recommended Cu limit is 0.002 mg/liter total Cu, but existing levels and the effects of local water quality must be considered when setting an objective for Cu for specific water bodies. It is recommended that Cu concentration in livestock drinking water not exceed 1 mg/liter for sheep/cattle, and 5 mg/liter in all other cases. For continuous irrigation on all soils or intermittent irrigation of land having Cu-sensitive plants (e.g., vegetables), total Cu in irrigation water should not exceed 0.2 mg/liter. Recommended limits for Cu for recreational waters and industry water should be 0.5 mg/liter in both cases. Tabular data on global Cu sources to the environment, Cu emissions to the atmosphere, short-term lethal tolerance of freshwater invertebrates, and sublethal/acute toxicities of Cu to fish are included. (Zielinski-MAXIMA) W83-00079

##### SOLID WASTE MANAGEMENT IN SOUTH AFRICA

National Inst. for Water Research, Pretoria (South Africa).

W. C. Tworeck.

CSIR Technical Guide K47, 1979. 130 p, 9 Fig, 12 Tab, 64 Ref.

Descriptors: \*Solid wastes, \*South Africa, \*Waste management, \*Standards, \*Landfills, Waste disposal, Environmental protection, Land disposal, Hazardous materials, Municipal wastes, Waste dumps, Solid waste disposal, Garbage dumps, Waste recovery, Recycling, Sanitary landfills, Domestic wastes.

This guide describes various processes for solid waste management, including its production, collection, composition, and disposal. Special attention is given to sanitary landfilling, still the most efficient and economic means of solid waste disposal in most cases. The location and operation of suitable landfilling sites that effectively abate potential water/air pollution assists the reclamation of otherwise unsuitable/marginal land. Three different methods of sanitary landfilling are described: trending; area filling; and progressive slope methods. Sources of toxic wastes and suitable methods for their disposal are discussed in detail. It is recommended that recovery of material from solid waste should be propagated. In addition, special reference is made to the composting of solid waste. The guide is intended to assist managers in the municipal area with problems that arise from solid waste management and disposal, particularly those who have to consider the installation of new solid waste processing equipment or disposal facilities. Special attention is given to the environmental impact of wastes on disposal sites where they will affect the environment over extended period of time. (Zielinski-MAXIMA) W83-00090

##### SIMPLE CONTROL TESTS FOR OPERATORS OF SMALL WASTEWATER TREATMENT PLANTS

National Inst. for Water Research, Pretoria (South Africa).

For primary bibliographic entry see Field 5D. W83-00092

##### THE ECOLOGY OF THE MANGROVES OF SOUTH FLORIDA: A COMMUNITY PROFILE

Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

For primary bibliographic entry see Field 6G. W83-00093

##### CHEMICAL SURVEILLANCE OF RIVERS

Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

For primary bibliographic entry see Field 5A.  
W83-00134

**NEW EPA SODIUM AND CORROSION REGULATIONS: THEIR BASIS AND IMPACTS,**  
Camp, Dresser, and McKee, Inc., Boston, MA.  
J. C. Thompson.

Journal of the New England Water Works Association, Vol 96, No 2, p 104-108, 1982. 1 Tab, 11 Ref.

Descriptors: \*Water quality standards, \*Sodium, \*Corrosive water, Regulations, Standards, Pipes, \*Massachusetts, Water treatment, Drinking water.

The EPA promulgated amendments (August 1980) to the Interim Primary Drinking Water Regulations of the Safe Drinking Water Act which require monitoring of public water supplies for corrosivity and sodium levels. The Massachusetts Department of Environmental Quality Engineering is in the process of establishing a new sodium policy. Limiting the corrosivity and sodium levels promotes public health. Dangers of corrosive water, in addition to the unesthetic colors sometimes found, include high levels of Pb, Cd, Zn, Cu, and asbestos. Excessive Na levels are also undesirable for persons on a Na-restricted diet. EPA requires monitoring at specified intervals for Na and for corrosivity, as based on the Langmuir Index. Pipe construction materials must be analyzed to detect the presence of Pb, Cu, galvanized, ferrous, and asbestos cement materials. The present Massachusetts regulations, more stringent than EPA requirements, will also require permission to use any water treatment chemicals that could increase Na levels. (Cassar-FRC)  
W83-00137

**WATER QUALITY IN URBAN STREAMS—WHAT WE CAN EXPECT,**  
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.  
For primary bibliographic entry see Field 5C.  
W83-00144

**EFFECTS OF MICHIGAN'S PHOSPHORUS DETERGENT BAN ON MUNICIPAL CHEMICAL COSTS,**  
Michigan Dept. of Natural Resources, Lansing. J. H. Hartig, F. J. Horvath, and R. C. Waybrant. Journal of the Water Pollution Control Federation, Vol 54, No 3, p 316-317, March, 1982. 3 Tab, 4 Ref.

Descriptors: \*Phosphorus, \*Municipal wastewater, \*Cost analysis, Wastewater treatment, Water pollution control, Chemical treatment, Detergents, Michigan.

The effect of Michigan's ban on the sale of household laundry detergents that contain more than 0.5% by weight of elemental phosphorus on chemical costs at selected municipal wastewater treatment facilities was evaluated. An earlier study showed that the ban resulted in a reduction of the phosphorus concentration in municipal treatment plant influents and effluent. Nine municipal wastewater facilities were investigated for chemical cost savings as a result of the ban. These plants each had phosphorus removal over the study period, experienced no changes in their phosphorus removal processes, and had complete data on chemical treatment and costs. Annual chemical usage at these nine plants decreased by 12 to 49% between the year prior to the ban and the year following implementation of the ban. Annual chemical costs for these plants decreased by \$113 to \$42,372, with no adjustment for inflation. Cost savings associated with equipment or other operation and maintenance costs for chemical feed systems were also not included. Total chemical cost savings resulting from the phosphorus ban were computed on a wastewater volume basis for each plant having chemical phosphorus removal. This analysis indicated a total annual cost savings in Michigan of about \$730,000 resulting from the ban. (Carroll-FRC)  
W83-00147

**MANAGEMENT AND CONTROL TECHNOLOGY FOR URBAN STORMWATER POLLUTION,**  
Santa Clara Univ., CA. Dept. of Civil Engineering. E. J. Finnemore, and W. G. Lynard. Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1099-1111, July, 1982. 5 Fig, 7 Tab, 36 Ref.

Descriptors: \*Storm water, \*Urban runoff, \*Combined sewer overflows, \*Water pollution control, Runoff, Vegetation, Reviews, Erosion control, Slope stabilization, Detention reservoirs, Sedimentation, Water storage, Storage, Planning, Land use, Cost analysis, Nonstructural alternatives.

Urban storm water management practices were summarized including approaches for managing and controlling pollution from urban runoff and combined sewer overflow. Best management practices (BMP), either nonstructural or low-structural, have been gaining recognition as cost-effective solutions to these problems. Nonstructural controls include institutional measures (planning and legislation), modification of maintenance practices (street cleaning), and control of development and natural land conditions to reduce runoff and pollution. Low-structural controls use natural land features with minor modifications and small simple structures to control pollution. These may be berms, earthworks, and outlet devices. The most common low-structural control is detention storage, usually constructed near the source of runoff or pollution. Erosion control methods include soil stabilization (matting, mulching, chemicals, tackifiers, and slope support), runoff control (diversion dikes, interception trenches, pipe drops, chutes and flumes, sediment barriers, and berms), and vegetation. Combined sewer overflows are generally handled by structural measures. Storage is the most important element. In-line storage (flow restriction and regulation devices and pumping stations) is most cost-effective and flexible. Off-line storage, alone or combined with in-line storage, includes sedimentation/storage tanks or ponds, some of which also provide treatment. Integrated systems (combined sewer overflow controls, dry-weather treatment facilities, plus BMP) are even more cost-effective. This review discloses several deficiencies in storm water management information such as limited performance data especially for integrated systems, insufficient cost data base, less information on source control strategy than on combined sewer overflow strategy, and lack of monitoring data to support the claimed benefits for storm water abatement programs. (Cassar-FRC)  
W83-00148

**OPERATION CONTROL.**  
Public Works, Manual, p D57-D62, 1982.

Descriptors: \*Mechanical equipment, \*Flow measurement, \*Wastewater facilities, \*Laboratory equipment, Flowmeters, Flow rates, Gages, Sampling, Safety, Photometry, Measuring instruments.

Equipment to monitor the flow through a wastewater treatment plant as well as performance of the plant under various conditions is discussed. Flow measurements may be necessary in open channels, weirs, flumes, pipes, and manholes. Meters are also available to measure sewage-sludge digester gas, sewage temperature, rainfall, and sludge thickness. Water samplers are frequently needed by treatment facilities, as is water testing equipment. Laboratory equipment is needed to determine the chemical, physical, and biochemical parameters of treatment streams. Photometric analyzers, safety instrumentation, and supervisory instrumentation are often needed. Details are given on various types of instruments available, and the names and addresses of manufacturers are included. (Small-FRC)  
W83-00155

**WATER QUALITY STANDARDS AND WATER QUALITY,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering. G. F. Lee, R. A. Jones, and B. W. Newby.

Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1131-1138, July, 1982. 1 Fig, 1 Tab, 16 Ref.

Descriptors: \*Water quality standards, \*Regulations, \*Water pollution control, Hazard assessment, Standards, Water pollution effects, Fish, Aquatic life, Toxicity, Chlorine.

Water quality standards developed by the EPA as mandated in Public Law 92-500 (fishable, swimmable waters by 1983) serve as a basis for state water quality standards. Developed on the basis of chronic, lifetime bioassays or extrapolation of results on test species, these standards are worst case criteria. The authors reflect the opinion of many in the technical and management communities and in Congress, that water quality should be evaluated in terms of its desired beneficial uses. Since a variety of physical, chemical, and biological factors affect the impact of a chemical on water at different sites, water quality standards should be developed on a site-specific basis. Much of the obvious, gross water pollution was abated in the 1970's. The public appears unwilling to spend huge sums of money to produce almost imperceptible improvement in water quality. An example is provided in which it is difficult to justify spending additional money on dechlorination for questionable benefits. The hazard assessment procedure, a tiered approach, enables the user to determine at each level the need for continued assessment to refine the estimate of the degree of hazard and the acceptability of the hazard that exists for a contaminant in a system. This confines costly field work to certain critical phases and reduces the number of required water analyses. Since this paper was completed in 1979, the EPA has made 2 relevant policy changes: (1) the policy of presumptive applicability was dropped, allowing states to adopt less stringent standards after appropriate justification, and (2) states must develop standards for all parameters for which the EPA has criteria. The authors question the wisdom of this second requirement because many of the 65 contaminants on the list are exotic. (Cassar-FRC)  
W83-00162

**LAW,**  
Virginia Water Resources Center, Blacksburg.  
For primary bibliographic entry see Field 6E.  
W83-00165

**DEVELOPING AND APPLYING INTERNATIONAL WATER QUALITY GUIDELINES,**  
Pan American Health Organization, Washington, DC.

V. M. Witt. Journal of the American Water Works Association, Vol 74, No 4, p 178-181, April, 1982. 2 Tab, 3 Ref.

Descriptors: \*Developing countries, \*Drinking water, \*Water quality standards, Water treatment, International commissions, Water supply development, Water pollution effects, Population exposure, Water quality management.

Since poor basic environmental sanitation is largely responsible for the high morbidity and mortality rates resulting from communicable diseases in developing countries, the World Health Organization (WHO) has given high priority to assisting member countries in their efforts to expand safe drinking water supplies and sanitation services. In 1977, the United Nations Water Conference declared the period 1981 to 1990 to be the International Drinking Water Supply and Sanitation Decade. Following this, WHO decided that a revision of the International Standards for Drinking Water (1971) was needed to reflect recent advances in scientific knowledge and practical experience relating to the presence of contaminants in water supplies and their effects on human health. In addition, WHO decided to prepare an internationally applicable set of Guidelines for Drinking Water Quality, which would present realistic approaches which would be applicable at the local level in developing countries. The International Standards contain information on criteria for hazardous and other noxious substances in drinking water. The standards design-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

note the scientific relationship between the level of exposure to pollutants and the risk or magnitude of the harmful effects; define the acceptable or permissible limits of concentration to protect a defined population from undesirable effects from exposure; and set action levels, which indicate when action should be taken to improve drinking water quality. The Guidelines will contain numerical suggestions for water quality and a summary of the rationale used for establishing the recommended limits; recommended sampling frequency and techniques; brief guidelines on the application of recommended limits and action levels; criteria or detailed health justification for the proposed limits; and specific guidelines for the application of drinking water quality criteria to make them responsive to the needs and realities prevailing in developing countries. (Carroll-FRC)  
W83-00167

#### MANPOWER NEEDS IN WASTEWATER TREATMENT AND COLLECTION SYSTEMS FOR THE YEARS 1980 TO 2000

Southern Illinois Univ. at Edwardsville. Environmental Resources Training Center.

J. O. Bryant, Jr.  
Journal of the Water Pollution Control Federation, Vol. 54, No. 3, p 213-228, March, 1982. 3 Fig, 16 Tab, 7 Ref.

Descriptors: \*Personnel, \*Wastewater treatment, \*Wastewater collection, Projections, Wastewater facilities, Water pollution control, Personnel management, Surveys.

Data from a staffing survey of wastewater treatment and collection facilities in the United States and Canada have been used to project staffing and personnel needs for the period 1980 through 2000 for 34 occupations in water pollution control treatment and collection systems. The survey was conducted by the Personnel Advancement Committee of the Water Pollution Control Federation. The survey showed that between 141,000 and 163,000 persons are currently employed in publicly owned wastewater treatment and collection systems, with about 20% more persons employed in collection systems than in treatment systems. There are about 10,000 job vacancies in wastewater collection systems and about 5,400 vacancies in treatment job categories. If all proposed construction activity is completed, total employment in wastewater treatment and collection systems should increase to about 252,000 employees by the year 2000. Although most water pollution control systems do not require formal education or training in wastewater treatment operational procedures prior to initial employment, about 60% require certification for promotion to supervisory positions and about half require certification for operators. Although the current system of hiring unskilled personnel for entry level positions results in a failure on the part of system operators to understand the skills required to operate and maintain treatment facilities and in workers being underpaid, this practice is likely to continue. In spite of the fact that over 80% of treatment and collection systems have inadequate on-the-job training programs, such programs are expected to continue to be the major method used to develop water pollution control operations technology skills and knowledge. There is at present little incentive for employees to develop job knowledge and skills beyond the minimum required to maintain employment. Although persons trained in water pollution control technology will probably not have problems locating jobs in the foreseeable future, they will probably find that employers undervalue their skills. (Carroll-FRC)  
W83-00200

Water Research Centre, Marlow (England). For primary bibliographic entry see Field 5A.  
W83-00196

#### CONTROL MEASURES FOR GROUNDWATER VOCs

Pirnie (Malcolm), Inc., White Plains, NY.  
For primary bibliographic entry see Field 5F.  
W83-00199

#### INTENSIVE FLOW MONITORING—COST-EFFECTIVENESS WITH A QUALITY EDGE

Thomas (Frank A.) and Associates, Inc., Wiloughby, OH.

J. N. Keele.  
Water/Engineering and Management, Vol 129, No 8, p 34, 36, 38, July, 1982. 1 Tab, 2 Ref.

Descriptors: \*Flow measurement, \*Monitoring, \*Sewer systems, Weirs, Sewer infiltration, Infiltration, Cost analysis.

The Intensive Flow Monitoring approach to sewer system evaluation surveys produces a better quality of information than other methods such as Intensive Weir. If this factor is included in a cost analysis, flow monitoring is more cost effective. Cost of two monitoring regimes are compared for a 1 million ft system with 60% already eliminated by gross flow monitoring during infiltration/inflow: (1) intensive monitoring of 4000 ft minisystems, and (2) two-stage weir program followed by intensive weir on a manhole-to-manhole basis, depending on night flow isolation to eliminate areas from further study. Total costs are \$409,250 for alternative (1) and \$512,375 for alternative (2) and are broken down into 9 tasks: manhole investigation, intensive flow metering, gross flow isolation, line by line flow isolation, smoke testing, dye water testing, interim report (25% of field work), TV cleaning, and final report. (Cassar-FRC)  
W83-00200

#### THE PLIGHT OF AMERICAN CITIZENS INJURED BY TRANSBoundary RIVER POLLUTION

For primary bibliographic entry see Field 6E.  
W83-00209

#### THE CLEAN WATER ACT'S SECTION 404 PERMIT PROGRAM ENTERS ITS ADOLESCENCE: AN INSTITUTIONAL AND PROGRAMMATIC PERSPECTIVE

Lewis and Clark Law School, Portland, OR.

M. C. Blumm.  
Ecology Law Quarterly, Vol 8, No 3, p 409-472, 1980. 333 Ref.

Descriptors: \*Water pollution prevention, \*Permits, \*Dredging, Water law, Wetlands, Clean Water Act, State jurisdiction, Federal jurisdiction, Legislation, Water quality management, Solid waste disposal, Fill permits, Law enforcement, Legal aspects, Fish, Wildlife, Dams, Water pollution sources, Land use, Water allocation, Streamflow, Runoff, Interagency cooperation.

Section 404 of the Clean Water Act regulates the addition of solid materials, such as dredged or fill material, into water bodies. It prohibits discharge into sensitive aquatic ecosystems and requires mitigating management practices for the allowed discharges. This paper discusses the history of the program since its creation in 1972; its scope and exemptions; the permit process; relations between the Corps of Engineers, EPA, and other agencies; the overlaps and gaps between the National Pollution Discharge Elimination System and 404; state 404 and 208 (b) (4) which concerns control of minor discharges of dredged material through best management practices; and integrating the 404 program with state land and water use control programs.

Since Section 404 regulates many types of activities, several federal agencies are involved and all must effectively cooperate. State and local groups must handle the one-time discharges related to land use practices. EPA should become more prominent as the lead 404 agency by promulgating

guidelines and assuming control over programs outside 404 that help attain its goals. The Corps of Engineers must promote enforcement of 404. Uniform standards are needed for issuing permits and monitoring activities and revising regulations involving wetlands. The Fish and Wildlife Service and National Marine Fisheries Service should aggressively enforce their mandates. States can require compliance with water quality and coastal zone certification requirements, actively implement state 404 and 208(b) (4) programs, and coordinate land and water use planning activities. Congress's role is providing funds for implementation of Section 404 and aid in training over permit authority to the states. The public can call attention to weak links in the program by entering suits and by monitoring results of court decisions. (Cassar-FRC)  
W83-00210

#### LAKE RESTORATION TECHNOLOGY TRANSFER ASSESSMENT

Pennsylvania State Univ., University Park.  
M. H. Daschbach, E. M. Roe, and W. E. Sharpe.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108258, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, June, 1982. 56 p, 4 Tab, 2 Append. OWRT C-00192-T (0496)(1).

Descriptors: \*Technology transfer, \*Lake restoration, \*Eutrophic lakes, \*Acid rain, Evaluation, Technology, Rehabilitation, Destratification, Environmental policy, Environmental protection, Eutrophication, Oligotrophic lakes, Aquatic productivity, Public participation, Acidic water, Air pollution.

Based upon a review of the eutrophication problem and its impact on lake restoration (LR) programs, treatment of the relatively new problem of acid deposition and its impact on LR activities, consideration of the LR programs of the Environmental Protection Agency and several States, and a review of individual LR technology transfer publications, it is recommended that new LR technology transfer programs be given a low priority until more new information is available on the restoration of acidified lakes. Both primary and secondary users of LR research, technology transfer documents, and public awareness documents were considered in this assessment. Primary users included the general public and recreationists, lake-shore property owners, lake/homeowner associations, lake/sanitary districts, and research and environmental organizations; secondary users included State/County/local officials who administer/manage water-related regulations/activities. If an LR program is funded, it should be designed to produce a new public awareness report updating current state-of-the-art on LR programs, or it should fund workshop(s) for primary/secondary users of LR information to update these groups on LR techniques, financial assistance sources, and programs elsewhere in the country. An OWRT summary report of research on acid deposition in the Northeast U.S. is recommended. (Zielinski-MAXIMA)  
W83-00215

#### A COOPERATIVE WATER RESOURCE TECHNOLOGY TRANSFER PROGRAM

Michigan State Univ., East Lansing. Inst. of Water Research.

For primary bibliographic entry see Field 6B.  
W83-00216

#### THE ROLE OF HYDROLOGIC VARIABILITY IN COMPLYING WITH REGULATORY ENFORCEMENT STANDARDS FOR THE REHABILITATION OF SURFACE-MINED COAL LANDS

Arizona Univ. Tucson. Dept. of Hydrology and Water Resources.

For primary bibliographic entry see Field 6G.  
W83-00223

#### REEVALUATION OF THE EFFECTS OF DEICING SALT RUNOFF ON A SMALL URBAN LAKE

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

Michigan Univ., East Lansing. Dept. of Zoology. For primary bibliographic entry see Field 5C. W83-00227

**NITRATE CONTAMINATION OF GROUND-WATER ON THE OLD MISSION PENINSULA: CONTRIBUTION OF LAND RESHAPING AND SEPTIC DRAINFIELDS,**  
Michigan State Univ., East Lansing. Dept. of Crop and Soil Science.  
For primary bibliographic entry see Field 5B. W83-00228

#### AN EVALUATION OF THE RECOVERY OF ADIRONDACK ACID LAKES BY CHEMICAL MANIPULATION,

Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering. J. V. DePinto, and J. K. Edzwald.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108498, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, June 1982. 127 p, 36 Fig, 29 Tab, 58 Ref, 3 Append. OWRT B-095-NY(1), 14-34-0001-9153.

Descriptors: \*Acidic water, \*Mountain lakes, \*Lake restoration, \*Eutrophic lakes, \*Neutralization, Acid rain, Acidity, Air pollution effects, Water pollution effects, \*Adirondacks, Rainfall, Lakes, Ecosystems, Chemical treatment, Limestone.

In order to develop alternative remedial methods for recovery of Adirondack acid lakes believed due to acid rain, a study was conducted on chemical manipulation methods for their neutralization. This study specifically addressed an evaluation of materials (calcium hydroxide and carbonate, agricultural limestone, fly ash, water treatment plant softening sludge, cement plant by-pass dust) for their neutralizing effectiveness and for establishing a neutral pH buffer system, and an evaluation of the effect of various lake recovery materials on algal growth. Laboratory continuous-flow microcosms were used as models to assess acid lake recovery. These models were filled with actual acid lake water over a layer of lake sediments, subjected to a given chemical treatment, and continuously fed water of selected quality (e.g., acid rain). A simulation of sediment-water-air kinetic interactions on a treated acid lake was obtained by careful monitoring of the microcosm chemical response. Agricultural limestone was determined to be the most appropriate material for acid lake recovery treatment based on its neutralizing properties, assessment of its potential impact on biota, its availability, and its relative cost. The results of this laboratory study suggest that full-scale recovery of an Adirondack acid lake is technically feasible. It is, however, recommended that an acid lake recovery field demonstration project be undertaken. (Zielinski-MAXIMA)  
W83-00245

#### A CURRICULUM FOR WATER SUPPLY AND WASTEWATER OPERATION, MAINTENANCE AND MANAGEMENT,

District of Columbia Univ., Washington. Water Resources Research Center. M. H. Watt.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108514, Price codes: A05 in paper copy, A01 in microfiche. DC WWRCC Report No 23, April 1982. 83 p, 3 Append. OWRT A-999-DC(2), 14-34-0001-0109.

Descriptors: \*Education, \*Wastewater management, \*Water analysis, \*Water pollution, \*Technology transfer, \*Water supply, Wastewater pollution, Wastewater disposal, Wastewater treatment, Water quality, Water quality control, Water quality standards, Water pollution treatment, Pollutant identification, Technology, \*District of Columbia.

A curriculum was developed for water supply and wastewater operation/maintenance/management, and is presented in two parts: (1) key water quality courses; (2) academic information to support the water resources courses. The description of the

water quality courses includes updates and revisions; the courses separately address the chemical analysis of water, properties of fresh water, water quality management, wastewater technology, and hydrology. Academic support information provided covers an inventory of laboratory equipment, lists of reference texts and audio-visual material useful to water resources training, and a survey of employment opportunities for water treatment plant operators in the metropolitan Washington, DC area. The survey revealed good employment opportunities for these operators. Specialized courses are also discussed: waterborne disease control for public health workers, wastewater treatment plant operators training program (basic and intermediate courses), and environmental protection (homestudy course for professional health workers). The results of this effort serve to revitalize a two-year water quality academic curriculum. (Zielinski-MAXIMA)  
W83-00247

#### WASTEWATER MANAGEMENT PROBLEMS IN RURAL COMMUNITIES,

Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.

J. Y. C. Huang.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108530, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center University of Wisconsin, Technical Report WIS WRC 82-02, Milwaukee, 1982. 22 p, 8 Tab, 13 Ref, 2 Append. OWRT A-087-WIS(1), 14-34-0001-0153/1153.

Descriptors: \*Wastewater management, \*Wastewater treatment, \*Rural areas, \*Institutional constraints, \*Statistical analysis, Wastewater disposal, Wastewater, Management planning, Planning, Septic tanks, Disposal wells, Storage tanks, Permits, Legal aspects, Fill permits, Water tanks, Septic wastewater, Correlation analysis.

The knowledge, experience, and attitudes of wastewater treatment on-site disposal systems users were examined in order to identify possible problems confronting institutional management of on-site systems in Wisconsin. These systems are individually owned and are scattered over relatively large areas. The major source of homeowner service experience is from septic tank pumping firms and plumbers; about 82% of the septic tank owners interviewed were satisfied with the performance of their units (due to low main tenance costs/requirements, and low taxes associated with the units). Homeowners with holding tanks, however, were dissatisfied with their systems (due to inconvenience and cost of frequent pumping requirements). Applying chi-square statistical analysis, eight significant correlations between pertinent variables were established. Management difficulties and measures for mitigating problems were identified, providing information needed to improve homeowner on-site disposal systems. The use of rural permit fees and other service fees were found to vary considerably among counties; the annual budget and staffing among counties also varied. On-site disposal system type and quantity information was only furnished by 50% of the counties responding; of these, only 50% could provide information on the estimated percentage of system failures. (Zielinski-MAXIMA)  
W83-00249

#### NON-POINT POLLUTION CONTROL FOR RANGELAND WINTERING, LIVESTOCK OPERATIONS (GROUND COVER),

Idaho Univ., Moscow. Coll. of Engineering.

J. E. Dixon, A. J. Lingg, D. V. Naylor, D. D. Hinman, and G. R. Stephenson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108563, Price codes: A03 in paper copy, A01 in microfiche.

Idaho Water and Energy Resources Research Institute, Completion Report, Idaho University, Moscow, June, 1982. 31 p, 2 Fig, 14 Tab, 4 Ref, 1 Append. OWRT A-064-IDA(1), 14-34-0001-0114.

Descriptors: \*Nonpoint pollution sources, \*Pollution load, \*Livestock, \*Stream pollution, \*Irrigation effects, Cattle, Grasses, Alfalfa, Streams,

Range grasses, Rocky Mountains, Stochastic process, Runoff, Analysis of variance, Mathematical studies, Water analysis, Pollutant identification.

An investigation was made of stream-side cattle winter holding areas as potential sources of non-point-water pollution. Mass balance calculations were made for each of various measured constituents, based on irrigation inflow, runoff, and constituent concentrations. The results of these calculations quantify the pollutant loss from land wintering cattle. An analysis of variance showed no significant difference between the ground cover (hay crop) treatment means for any constituent. There was, however, a trend toward better pollutant retention with alfalfa and fescue mixture. Other grasses used with alfalfa were bromegrass and orchard grass. The test plots were irrigated twice each year. The effect of the first versus the second irrigation was also analyzed, but no significant difference in pollutant retention was noted. Stream water samples were analyzed for ammonia, nitrate, total nitrogen and phosphorus, orthophosphate, sodium, potassium, calcium, magnesium, and chloride. Other determinations made included biological and chemical oxygen demands, dissolved oxygen, total organic carbon, suspended solids, and bacterial counts for fecal coliforms and streptococci, and for total coliforms. The data should be limited to situations involving runoff from irrigation water. It was concluded that the amount of pollutant loss to streams through irrigation return flow from land wintering cattle seems quite small. (Zielinski-MAXIMA)  
W83-00252

#### THE LAUREL RUN ACID MINE DRAINAGE RENOVATION DEMONSTRATION FACILITY: AN EVALUATION,

Pennsylvania State Univ., University Park. Coll. of Agriculture.

W. E. Sharpe, M. A. Vanagel, and L. S. Sherwin. Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108621, Price codes: A04 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources, Completion Report, Pennsylvania State University, University Park, April 1982. 59 p, 19 Fig, 3 Tab, 2 Ref, 5 Append. OWRT A-057-PA(1), 14-34-0001-1140.

Descriptors: \*Acid mine drainage, \*Wastewater renovation, \*Groundwater pollution, \*Wastewater facilities, Mine drainage, Water quality, Irrigation, Wastewater treatment, Feasibility studies, Forests, Hardwood, Acidic water, Acidic soils, Soil water, Water treatment facilities.

An acid mine drainage treatment demonstration was constructed to treat discharges from a small drift coal mine. Acid drainage was stored in a small impoundment, and used to irrigate a limed 0.23 hectare natural hardwood forest plot at 11.4 cm/week. Appreciable iron and sulfate removed and a decrease in specific conductance occurred in the storage pond. Gravity flow irrigation of the plot further improved mine discharge water quality, but pH improvement was minimal and sulfate and aluminum levels remained high in shallow groundwater samples taken just downslope of the irrigated area. The success of this demonstration facility was limited by the acidic poorly-drained soils used for irrigation. Plot tree mortality increased during the demonstration study. Tree presence made renovation more difficult and prevented soil incorporation of applied lime. Water quality of the area was slightly better while the treatment system was in operation. It is concluded that soil renovation of acid mine drainage is a promising low-cost treatment process that requires further field testing under more favorable soil conditions. The application rates used should be decreased proportionally to increased acid mine drainage strength. (Zielinski-MAXIMA)  
W83-00258

**NITRATE MOVEMENT AND DENITRIFICATION DEFINED RELATIVE TO BROMIDE TRACER IN TILE-DRAINED LAND,**  
Iowa State Water Resources Research Inst., Ames. For primary bibliographic entry see Field 5B. W83-00264

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

#### THE EFFECTS OF EXCESSIVE NITROGEN AND PHOSPHORUS IN SURFACE WATERS OF A PRAIRIE MARSH,

Iowa State Univ., Ames. Dept. of Botany.

C. B. Davis, and R. K. Neely.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108050. Price codes: A07 in paper copy, A01 in microfiche. Report ISWRRI-125, Iowa State Water Resources Research Institute, Iowa State University, Ames, July 1982. 129 p, 22 Fig, 8 Tab, 47 Ref, 3 Append. OWRT A-080-IA(1).

Descriptors: \*Nitrogen, \*Phosphorus, \*Marshes, \*Surface water, \*Wastewater renovation, Water quality, Wetlands, Marsh management, Wastewater disposal, Intertidal water, Fertilization, Experimental design, Nitrates, Plant growth, Phosphates, Ammonium.

Use of natural wetlands as wastewater renovation sites requires knowledge of short- and long-term effects of nutrient enrichment on the ecosystem. Research was carried out to assess the impact of nitrogen (N) and phosphorus (P) enriched marsh waters on ovals of N and P in intertidal water, and on emergent plant production and on decomposition. Ammonium nitrate and diammonium phosphate were applied to surface water of an Iowa prairie marsh (Eagle Lake) in 1979 and 1980. Application in 1979 caused increases of ammonium-N (AN), nitrate-N, and phosphate-P (PP) in 15-cm intertidal water of 144, 291, and 47%, respectively. Fertilization in 1980 caused increases in AN, PP, and the non-PP fraction of total P of 189, 60, and 50%, respectively, at the same depth. *Typha glauca* (TG) and *Sparganium eurycarpum* (SE) responded with increased N levels in shoots (30-34% for SE; 7-15% of TG) and root-rhizomes (SE, 25%; 38%); and increased 1980 shoot density (SE, 20%; TG, 30%) and shoot production (SE, 86%; TG, 36%). Root-rhizome production was not altered, nor was the rate of SE or TG shoot and root-rhizome decomposition. However, over 50 days, N and P levels increased in above-ground tissues of both species with fertilization, and root-rhizome litter consistently lost N under unfertilized and fertilized conditions (24-54% for the two species). The results suggest decomposing below-ground litter is a continuous source of N under both fertilized and unfertilized conditions. (Zielinski-MAXIMA)

W83-00266

#### ALGAE REMOVAL BY INDUCED AIR FLOTATION,

Louisiana Water Resources Research Inst., Baton Rouge.

M. E. Tittlebaum, and S. Holtzman.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108142. Price codes: A03 in paper copy, A01 in microfiche. Completion Report, May 1982. 39 p, 4 Fig, 6 Tab, 30 Ref. OWRT A-053-LA(1), 14-34-0001-1120.

Descriptors: \*Algal control, \*Aquatic plants, \*Flootation, \*Foaming, \*Surfactants, Algal growth, Amphibious plants, Aquatic weeds, Floating plants, Aerosols, Water treatment, Prototype tests, Testing procedures, Flocculation, Chemical coagulation, Dispersants, Water quality, Water quality control, Resins, Cation exchange.

Investigation was made of the feasibility of induced air flotation (IAF) as a method of removing free-floating algae from water. Bench scale tests were carried out to determine removal efficiency, run times, chemical additive concentrations, and the effects of other parameters on the process. Different organic polyelectrolytes were screened and tested as suitable additives. Significant algae removal was obtained with two medium molecular weight commercial polyelectrolytes: (1), a cationic flocculent consisting of a quaternary ammonium salt; (2) a cationic surfactant consisting of a tertiary amine conjugate acid. The former additive removed up to 92% algae when used as the IAF additive at 3 mg/liter at pH 10 for 2 minutes; the latter removed up to 80% for 2 minutes, and produced more desirable foam characteristics for removal from a flotation vessel than the former additive. A larger part of the algal floc produced

in tests with the flocculant adhered to the sides of the vessel and to the air injection tube. The surfactant produced a large foam appearing as single algal cells or small algal coagules attached to the bubbles which could be easily removed. (Zielinski-MAXIMA)

W83-00277

#### WATER QUALITY SIMULATION OF WAHIAWA RESERVOIR, O'AHU, HAWAII,

Hawaii Univ., Honolulu. Water Resources Research Center.

S. F. Moore, G. S. Lowry, G. P. Young, and R. H. F. Young.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108183. Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 138, September, 1981. 76 p, 15 Fig, 4 Tab, 17 Ref, 5 Append. OWRT A-085-HI(2), 14-34-0001-0113/1113.

Descriptors: \*Computer models, \*Hawaii, \*Simulation analysis, \*Water quality management, \*Aeration, \*Water supply, \*Reservoir operation, Model studies, Model testing, Mathematical models, Mathematical studies, Reservoirs, Water quality, Stochastic hydrology, Stochastic process, Prediction, Management planning, Water quality, Multipurpose reservoirs, Water management, Water pollution control, \*Wahiawa reservoir, Oahu.

A computer simulation model of water quantity and quality in Wahiawa Reservoir was developed and applied. The model represents the reservoir as a dynamic one-dimensional (vertical) system, with emphasis placed on representation of vertical and temporal changes in water level, water temperature, and dissolved oxygen. A novel model feature is the inclusion of artificial aeration effects. Statistically-valid comparisons between simulated and observed water quality data over a one-year period were used for model calibration; however, this calibration afforded a low predictive accuracy (especially for temperature) for the model. Despite this, the general reservoir response behavior was well represented by the model. The model was used to evaluate alternate water quality management strategies. Use of the model to predict effects of the strategies showed that anaerobic conditions depend on oxygen-demanding sediments and high algal productivity in surface waters. Artificial aeration appeared as the most effective water quality management strategy. Simulated aeration during critical low-flow conditions caused full mixing of the aerated layer and maintenance of well-oxygenated water. (Zielinski-MAXIMA)

W83-00281

#### BACTERIOPLANKTON AFFECTED BY PHOSPHORUS PRECIPITATION TREATMENT IN A POLYTROPHIC LAKE,

Bayerisches Landesamt fuer Wasserwirtschaft, Munchen (Germany, F.R.).

C. Steinberg, and P. Niesslbeck.

Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 2, p 43-46, 1981. 6 Fig, 18 Ref.

Descriptors: \*Bacteria, \*Plankton, \*Phosphorus removal, \*Lakes, Aluminum chloride, Chemical precipitation, Carbon dioxide, Absorption, Chlorophyll A, Algae, Phosphorus, Biomass, Aquatic productivity, \*West Germany, Carbon dioxide dark fixation, Seasonal variation, Phytoplankton, Fischkaltersee.

The bacterioplankton population of the Fischkaltersee, a lake in Upper Bavaria (Federal Republic of Germany) was monitored to assess the effects of artificial phosphorus precipitation using aluminum chloride. Direct counts of the bacterioplankton, selected plate counts, bacteriochlorophyll A readings, and CO<sub>2</sub>-dark uptake measurements were taken. After precipitation treatment, bacterial densities (direct count) decreased from 9.5 x 10<sup>9</sup> to 5.5 x 10<sup>8</sup> bacteria per sq cm. This partial breakdown of population did not exceed levels measured after a natural breakdown 4 months previously. One week after aluminum input, bacterial density had returned to its former level, and this was accompanied by a recovery of phytoplankton. Biological transport of phosphorus by the predominant alga,

Oscillatoria redekei, was assumed to be the cause of rapid phosphorus replenishment in the productive layers. Changes found in saprophytic bacteria supported these results. Plotting direct counts against the sum of plate counts (Razumov quotient) resulted in great variations, and the slight shift toward plate count bacteria after aluminum treatment did not exceed the natural range. Biogenesis structure proved to be stable. Aluminum treatment decreased the bacterial biomass from 13 to 10 micrograms per liter. Microbial activity represented by CO<sub>2</sub>-dark fixation exhibited damage after treatment, declining greatly. The reduction may have been due partly to coprecipitation of microbial substrates with aluminum, though the reduction did not parallel readings for dissolved organics. Low winter temperatures at the time of treatment may also have played a role. (Gish-FRC) W83-00315

#### WATER QUALITY CRITERIA AND EFFLUENT REQUIREMENTS IN BROWARD COUNTY, FLORIDA,

Montgomery (James M.), Inc., Pasadena, CA.

G. P. Trewick, and R. J. TeKippe.

Journal of the Water Pollution Control Federation, Vol 54, No 3, p 298-308, March, 1982. 15 Fig, 4 Tab, 2 Ref.

Descriptors: \*Ocean dumping, \*Water quality control, \*Wastewater treatment, Wastewater facilities, Water quality standards, Data interpretation, Management planning, Regional planning, Broward County, \*Florida.

Two engineering techniques were applied in Broward County, Florida, to determine whether discharge of treated secondary effluent into ambient waterways could be continued and, if not, how this effluent could be discharged into the Atlantic Ocean while meeting stringent 500 to 1 initial dilution requirements. Water quality data with respect to time and distance along the inland canals, which currently receive the wastewater discharges, were displayed topographically, allowing the engineer to rapidly assess the factors which most significantly affect the canal water quality without incurring high computer modelling costs. Recent research into the effects of ocean current on the extent of initial dilution of wastewater plumes was then utilized in evaluating options for ocean disposal. The water quality topographs showed that existing water quality standards could not be met even if current wastewater facilities incorporated tertiary treatment prior to discharge to the inland canals. A decision was made to construct three large regional wastewater treatment facilities at the coast with discharge through ocean outfalls and diffusers into the Atlantic Ocean. Although the existing temperature stratification does not permit the use of a single-plume outfall structure, use of a 2,000-foot diffuser structure oriented to take advantage of the offshore currents will permit the minimum dilution standard to be met at least 90% of the time. (Carroll-FRC) W83-00320

#### USE OF THE WATER-SALT BALANCE METHOD FOR CALCULATING THE DESALINATION REGIME OF A LARGE WATER BODY,

E. S. Zasukhina, and V. S. Zasukhin.

Water Resources, Vol 8, No 4, p 373-377, July/August, 1981. 3 Fig, 2 Ref. Translated from Vodnye Resursy, No 4, p 71-76, July/August, 1981.

Descriptors: \*Desalination, \*Lakes, \*Salt balance, Rivers, Canals, Lake Tharthar, Tigris River, Euphrates River, Flow control, Saline lakes, Model studies, Mixing, Water management, Water quality control.

Equations for water and salt balance are used to describe the desalination of a large water body by passing weakly mineralized water through it. For example, water from a river flows into a water body (lake) via a canal, mixes with saline lake water, and returns to the river further downstream via a second canal. A sample solution is given for Lake Tharthar, which communicates with the

## Evaluation Process—Group 6B

**Tigris and Euphrates Rivers.** The lake contains 150 million tons of salts dissolved in 62.2 cu km of water, or 2490 mg salt per liter. The maximum capacities of the 2 canals are 600 cu m per sec in the Tharthar-Tigris and 500 cu m per sec in the Tharthar-Euphrates. The value for maximum allowable salt concentration in the downstream section of the river is 800 mg per liter. Calculations show that desalination of the lake to the desired 800 mg per liter level can be accomplished by 1987 using a two-canal system and by 1994 using only the Tharthar-Euphrates canal. (Cassar-FRC) W83-00322

**POTENTIAL APPLICATIONS OF WATER HYACINTH FOR WATER, AIR RECYCLING IN CLOSED SYSTEMS,** Maryland Eastern Shore Univ., Princess Anne, Dept. of Natural Science.

G. Gupta.

Water, Air, and Soil Pollution, Vol 17, No 2, p 199-205, 1982. 34 Ref.

Descriptors: \*Water hyacinth, \*Wastewater renovation, \*Closed systems, Evapotranspiration, Water reuse, Aquatic plants, Wastewater treatment, Ecosystems.

The water hyacinth is one potential biological component of closed ecological life support systems being investigated for use in manned space missions. These closed systems may use higher plants and algae both for recycling water and air and for regeneration of food. Aquatic vascular plants, including water hyacinth and duckweed, have been successfully used in the treatment of municipal, agricultural, chemical, and industrial wastewaters. The water hyacinth has been very effective in removing algae, fecal coliforms, suspended particles, trace toxic metals, pesticide residues, organics, heavy metals, and many other dissolved impurities from wastewater used for plant culture. Water hyacinth loses a substantial amount of water through evapotranspiration, with some studies reporting the recovery of as much as 40% of the wastewater as pure water through evapotranspiration by water hyacinth growing on the wastewater. Water hyacinth absorbs carbon dioxide from both air and water and generates oxygen through photosynthesis. Water hyacinth, when grown over wastewater in a controlled environment/closed system, can efficiently clean up the wastewaters, provide fresh water, and possibly clean up the air by removing carbon dioxide and releasing oxygen. In addition, this aquatic plant may be used as feed for livestock and other animals, as a protein source for humans, as a source of methane, as fertilizer and compost, and for other miscellaneous purposes. (Carroll-FRC) W83-00324

## 6. WATER RESOURCES PLANNING

### 6A. Techniques Of Planning

**POLICY OBJECTIVES AND INFORMATION SYSTEM FOR IRRIGATION PROJECTS-INDIA,** Center for Development Research, Hyderabad

P. K. Rao.

Water Supply and Management, Vol 6, No 3, p 243-259, 1982. 1 Fig, 1 Tab, 10 Ref.

Descriptors: \*Data transmission, \*Irrigation practices, \*Policy making, \*Management planning, Data storage and retrieval, Hydrologic data collections, Irrigation requirements, Irrigation efficiency, Water supply development, Water management, Planning, \*India.

The value of a good information system both in general and specifically in the management of efficient irrigation systems in India is reviewed. A lack of clear objectives in the planning and management of water resources often leads to the evolution of a poor information system. The efficient use of water resources alone does not constitute a well-defined

objective, but is often mistaken for one in irrigation management. The role and limitations of water use efficiency criteria set forth by the International Commission on Irrigation and Drainage are outlined and their associated information requirements are discussed. The Draft Water Management Manual of Andhra Pradesh is briefly reviewed to illustrate the operation of a State Irrigation Department in terms of reporting systems and data transmission. Control of irrigation in a Warabandi (water rotation) system is discussed. To make use of information for irrigation management, adequate water distribution system and measuring instruments are required. (Geiger-FRC) W83-00011

**THE PROBABILITY DISTRIBUTION OF WATER INPUTS AND THE ECONOMIC BENEFITS OF SUPPLEMENTARY IRRIGATION,** International Inst. for Applied Systems Analysis, Laxenburg (Austria). R. J. Anderson, Jr. Water Supply and Management, Vol 6, No 3, p 281-291, 1982. 5 Tab, 3 Ref.

Descriptors: \*Mathematical models, \*Statistical methods, \*Economic aspects, \*Irrigation efficiency, \*Planning, Water supply development, Model studies, Mathematical studies, Crop production, Irrigation practices, Irrigation requirements, Capital.

The relationship between changes in the probability distribution of water inputs to crop production induced by supplementary irrigation and economic benefits of supplementary irrigation determined by increased expected farm income is examined. The contribution of supplementary irrigation to expected farm income depends partly upon its effect on the mean of the water input distribution and partly upon its effect on the variance of the water input distribution. The reduced variability of the distribution of water input allows economic benefits even when the effect of supplementary irrigation on the mean of the water input distribution is negligible. This conclusion does not depend upon any special assumptions about the farmer's attitude toward risk. The present analysis may also be used to study the economic effects of climate change. (Geiger-FRC) W83-00016

**RESERVOIR MANAGEMENT IN POTOMAC RIVER BASIN,** Washington Univ., Seattle. Dept. of Civil Engineering.

R. N. Palmer, J. A. Smith, J. L. Cohon, and C. S. Revelle.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WRI, p 47-66, March, 1982. 6 Fig, 2 Tab, 47 Ref.

Descriptors: \*Metropolitan water management, \*Reservoir operation, \*Mathematical studies, Reservoir yield, Simulation analysis, Linear programming, Water supply, Management planning, River basins, \*District of Columbia, \*Potomac River, Patuxent River, Water resources development.

Techniques for determining the yield of multireservoir water supply systems have been developed and applied to the system that serves the Washington, DC, metropolitan area. This area is served by three agencies which obtain water from the Potomac and Patuxent River basins and from the five reservoirs which lie in these basins. A simulation technique which was extended to include multireservoir systems operated in conjunction with free flowing rivers was used to determine the yield of each reservoir in the system. Linear programming models which incorporated projected water demands and limitations on the distribution and treatment capacities of the agencies supplying water to the area were used to perform a multiobjective analysis of conflicting water use objectives in the region. Analyses using the simulation technique and the linear programming models demonstrated that a significant degree of synergism exists within the regional water supply system and that proper joint management of the water resources can result

in an increase in yield equivalent to the capacity of a large reservoir. Current treatment and withdrawal limitations decrease the historic yield of the system by about 100 million gallons per day. For several formulations, the results obtained using the simulation models were equivalent to those obtained from linear programming models. (Carroll-FRC) W83-00203

**RURAL WATER SUPPLY SYSTEMS: IMPROVED PLANNING STRATEGIES THROUGH SYSTEMS ANALYSIS,** Iowa State Univ., Ames. Dept. of Civil Engineering.

T. A. Austin, R. S. Schulz, and R. B. Robinson. Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108456, Price codes: A05 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Report ISWRRI 76, Iowa State University, Ames, June 1982. 89 p, 27 Fig, 7 Tab, 22 Ref. OWRT A-048-IA(7), 14-31-001-5105.

Descriptors: \*Iowa, \*Water conveyance, \*Rural areas, \*Systems analysis, \*Optimum development plans, \*Peak demand, \*Livestock, Dynamic programming, Input-output analysis, Optimization, Systems engineering, Design criteria, Water supply, Potential water supply, Water supply development, Planning, Water use.

Research was carried out to assess the state-of-the-art of planning strategies currently used by institutions and consultants in planning rural water supply systems, and to explore systems analysis techniques for improving the planning/design/operation/management of such systems. Peak use periods with large livestock populations were larger than those seen in high density residential areas, occurring between 7:11 AM and 4:30-8:30 PM. Nomographs from literature data indicating daily livestock water consumption appear to provide reasonable predictions of livestock water needs based on animal weight and average ambient temperature. Peaking factors seen for two test sections were higher than would be used for design of water systems for residential/industrial/commercial water use. Restricted to only residential water system design criteria, the peaking factors fall within acceptable ranges. The currently used plant capacity design value (60 gallons/capita/day) is in line with observed per capita use if a small reserve is considered for future growth. A method was developed and demonstrated for optimizing a branching rural water distribution system, considering: pipe diameter, pipe pressure rating/class, pressure regulating valve location and setting, and initial head. It is most appropriate to gravity flow areas from a water tower. Any dead and pipe network can be analyzed with this method if the head loss/unit pipe length is obtainable from flow and pipe diameter. (Zielinski-MAXIMA) W83-00241

**EFFECTIVE GRAPHICAL DISPLAY OF WATER RESOURCE PLANNING INFORMATION FOR DECISION MAKERS, VOLUME I,** Gates (W. E.) and Associates, Inc., Batavia, OH. For primary bibliographic entry see Field 10D. W83-00273

**EFFECTIVE GRAPHICAL DISPLAY OF WATER RESOURCES PLANNING INFORMATION FOR DECISION MAKERS, VOLUME II,** Gates (W. E.) and Associates, Inc., Batavia, OH. For primary bibliographic entry see Field 10D. W83-00274

### 6B. Evaluation Process

**LUMP SUM TAX LOSS REIMBURSEMENT UNDER THE THAMES RIVER FLOOD CONTROL COMPACT,** Massachusetts Univ., Amherst. Dept. of Food and Resource Economics. D. A. Storey, D. A. Lass, J. Diamond, and B. E. Lindsay.

## Field 6—WATER RESOURCES PLANNING

### Group 6B—Evaluation Process

Water Resources Bulletin, Vol 18, No 3, p 409-414, June, 1982. 1 Fig, 6 Tab, 9 Ref.

Descriptors: \*Flood plain management, \*Mathematical studies, \*Water law, \*Taxes, \*Cost allocation, Interstate compacts, Flood control, Flood prevention, Projections, Future planning, Interstate commissions, Massachusetts, Connecticut, Recreation, Thames River.

Under the terms of the Thames River Valley Flood Control Compact, the state of Connecticut must pay Massachusetts 40% of the annual property tax losses suffered by seven Massachusetts towns where four flood control structures are located. In the present study, the alternative of a lump sum payment was examined which would be the proportion of total benefits (flood control plus recreation) which Connecticut receives, multiplied by the present value of projected tax losses in the seven towns. A survey was made to estimate the recreational benefits of the structures and their distribution. Equations for projecting future tax losses were generated from regression analysis of 1957 to 1978 tax loss data. Present tax loss values were determined using discount rates ranging from 6 to 12%. A feasible range of lump sum reimbursements as of 1979 was formulated. (Geiger-FRC) W83-00005

#### IRRIGATION PLANNING IN THE TANA BASIN OF KENYA,

University Coll. of Swanea (Wales). Centre for Development Studies.

S. K. Saha.

Water Supply and Management, Vol 6, No 3, p 261-279, 1982. 3 Fig, 5 Tab, 31 Ref.

Descriptors: \*Kenya, \*Social impact, \*Irrigation programs, \*Ecological effects, Tana River basin, \*Water resources development, Rural areas, Social aspects, Environmental effects, Water management, Water policy, Regional planning, Planning, Irrigation practices, Rural sociology.

Kenya's current population growth rate is among the highest in the world. For this reason, the country is becoming more dependent on food imports and needs to convert its rain-fed agriculture into irrigated agriculture. As a result, the Tana River basin has been targeted as a massive irrigation development site. In designing the irrigation program, the social aspects of planning have been overlooked, making the project of little benefit to the poorer rural population of the basin. In order to make full use of their land holdings and cultivate the full hectare, farmers will need more financial resources. The Mwea and Hola irrigation schemes have been only slightly more successful. Many smaller irrigation schemes are being planned for the Tana basin and other parts of Kenya. These too should include the social needs of the population in the planning process. (Geiger-FRC) W83-00015

#### HYDROLOGY AND WATER RESOURCES OF THE DRAKENSBERG,

Natal Univ., Durban (South Africa). Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 4A. W83-00085

#### SOCIAL AND POLITICAL ASPECTS OF DROUGHT,

Kraeger Associates, Ltd., Aptos, CA.

R. K. Kinsley.

Bulletin of the American Meteorological Society, Vol 63, No 6, p 586-592, June, 1982. 3 Fig, 1 Tab, 2 Ref.

Descriptors: \*Water supply, \*Water conservation, \*Arid-zone hydrology, Political aspects, \*Drought, Social aspects, Costs, Water resources development, Water scarcity, Water management, Arid lands, Semiarid lands, Water storage, Groundwater depletion.

The available surface water which can be put to beneficial use is far less than the mean annual flow of a stream, and is an inverse function of the

coefficient of variation of the annual flows. In arid regions where the water needs are greater, the usable fraction of the flow is the least. When the coefficient of variation is unity, less than 80% of the mean annual flow is usable. When evaporation and instream flow maintenance are counted, this figure could be reduced to 50%. With moderate instream flow requirements, 66 to 75% of the mean flow may be usable, but this fraction will probably decrease when cost is considered. Groundwater may serve as an important reserve in time of drought, but only if its use is carefully managed. Drought may become increasingly more common in arid and semiarid regions, unless water resources are carefully watched. A reservoir will be of little use in dry regions unless its water supplies can be saved only for use periods during of drought. Much of the western United States is already using water at or above the effective maximum limits. The prospects for water supply development in these regions is poor and more frequent periods of drought should be expected. (Geiger-FRC) W83-00186

#### A COOPERATIVE WATER RESOURCE TECHNOLOGY TRANSFER PROGRAM,

Michigan State Univ., East Lansing. Inst. of Water Research.

F. M. D'Itri.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108266. Completion Report, June, 1982. 49 p, 12 Append. OWRT A-104-MICH(1), 14-34-0001-8024.

Descriptors: \*Technology transfer, \*Public participation, \*Conferences, \*Economic aspects, \*Water quality, Water resource development, Eutrophication, Eutrophic lakes, Groundwater pollution, Irrigation practices, Storm water, Wastewater treatment, Acid rain, Regional analysis, Regional planning, Water quality control.

This cooperative water resource technology transfer program sought to develop/present educational programs (conferences/seminars/workshops) and technology transfer brochures to enhance public awareness/appreciation of State water quality problems and to stress economic tradeoffs needed to resolve given problems. Accomplishments of this program for the different conferences held 1979-1981 are described (inland lake eutrophication: causes, effects, and remedies; contamination of groundwater supplies by toxic chemicals: causes, effects, and prevention; supplemental irrigation; stormwater management; cooperative research needs for renovation and reuse of municipal water in agriculture; selection and management of vegetation for slow rate and overland flow land application systems to treat municipal wastewater; effects of acid precipitation on ecological systems: great Lakes region; water competition in Michigan; Michigan natural resources outlook). The project afforded opportunities for developing/disseminating printed materials, visual aids, and on-site exhibits. The conferences varied from regional programs for local citizens to international exchanges of scientific research data. It was not possible to assess the most significant aspect of the project for participants/recipients or short-long term results; however, the programs brought together citizens, scientists, and local/State representatives which generated a sense of working together to overcome problems of mutual concern. (Zielinski-MAXIMA) W83-00216

#### CASE STUDY ANALYSES OF 208 PROGRAM EFFECTIVENESS IN IMPROVING REGIONAL WATER RESOURCES MANAGEMENT,

Brown and Caldwell, Pasadena, CA.

W. K. Ferry, W. O. Maddaus, D. G. Hurley, and W. J. Miller.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108449. Price codes: A06 in paper copy, A01 in microfiche. Completion Report to Office of Water Research and Technology, Wash, DC, April, 1982. 94 p, 10 Fig, 11 Tab, 37 Ref. OWRT C-00071-U(0483)(1), 14-34-0001-0483.

Descriptors: \*Case studies, \*Water resource development, \*208 Program, \*Regional planning, \*Institutional

constraints, \*Optimum development plans, Water resource institutes, Water management, Conservation, Water reuse, Public policy, Evaluation, Regional analysis, Regional development, Water quality, Water quality control, Low flow, Urbanization, Urban areas.

In order to identify more effective water resource management concepts applicable to urbanizing areas, problems and problem-solving activities of three regions which occurred before/during/after the 208 planning process were evaluated. The three case studies (San Diego area; San Francisco Bay area; Metropolitan Washington, DC area) were selected to focus on a variety of geographical areas, problems, levels of effort previously expended on water resources planning, and form of the existing management structure: Each water pollution control plan dealt with water supply, water conservation, and water reuse issues. In each case, the draft 208 plan, prepared to address regional solutions to common problems, were weakened to protect the traditional missions of local water agencies. Certain achievements were realized, including agreement on regional population growth to be accommodated by expanded water systems. Public involvement in water resources decisions was increased, and progress was made in improving the quality of water supplies. Cooperative benefits occurred during drought periods, partially due to the 208 process and its emphasis on regional cooperation (e.g., water exchanges, low flow agreements). While 208 effectiveness would have been enhanced if it had had a legal mandate for a regional water management plan, it did demonstrate how the underlying institutional framework reacts to regional water issues, and it did improve regional management. (Zielinski-MAXIMA) W83-00240

#### HO: FOR REESE RIVER NATURAL RESOURCES OF THE TOIYABE-TOQUIMA HIGHLANDS, CENTRAL NEVADA,

Nevada Univ. System, Reno. Desert Research Inst. J. M. Townley.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108571. Price codes: A08 in paper copy, A01 in microfiche. Publication No 41075, April, 1982. 160 p, 4 Fig, 268 Ref. OWRT A-101-NEV(1), 14-34-0001-1130.

Descriptors: \*History, \*Nevada, \*Reviews, \*Resources development, \*Land use, \*Literature review, Water resources development, Regional development, Land development, Land clearing, Toiyabes, Recreation demand, Agriculture, Geologic history, Surveys, Institutional constraints, \*Reese River.

An historical review is presented of issues which have underscored development of the Reese River Valley with respect to water and land resources, as part of a planned series examining the Humboldt River and its major tributaries. Interaction between natural resources and human occupation of this region in historic time is examined and interpreted. Maximum prosperity of the region was reached in the mid-1860's and, with short aberrations, has never reawakened. Population density along the Toiyabes has never been great, but people most often resided in communities rather than dispersing on the land. Exploitation of natural resources provided the initial impetus for development in the area; however, since two major highways now bisect the area and the region contains vast open space areas, recreational activities now supplement the economy. This review covers the gradual, accidental, and the generally typical exploration of central Nevada, the 1862-1868 peak activity period (mining, milling) in central Nevada, changes since 1867, legend and tradition, the development of agriculture in the Toiyabe highlands, the Indian influence, and the camps of the Toiyabes. While current occupation offers the potential for threatening sources and existence of materials ranging from timber and wildlife to soil, surface and groundwater, this potential has not yet been exercised. (Zielinski-MAXIMA) W83-00253

#### INCENTIVES FOR IRRIGATION WATER CONSERVATION IN AGRICULTURE,

## WATER RESOURCES PLANNING—Field 6

### Water Law and Institutions—Group 6E

Texas Tech Univ., Lubbock. Dept. of Industrial Engineering.  
For primary bibliographic entry see Field 3F.  
W83-00278

#### ESTIMATING HYDROLOGIC VALUES FOR PLANNING WILDLAND FIRE PROTECTION, H. W. Anderson, and C. B. Phillips.

In: *Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 411-416, 2 Tab, 14 Ref.*

Descriptors: \*Fires, \*Floods, \*Sedimentation, \*Water supply, \*Hydrologic aspects, Cost-benefit analysis, \*California, Watershed management, Mathematical models, Economic aspects.

Among the principal criteria for planning a system of wildland fire protection are measures of the values being protected. The cost of protecting these values is related to the economic and social benefits expected from them, the net effects that wildfire would have upon them in the absence of protection, the changes in fire effects that can be achieved by various levels and practices of fire protection, and of course, the people's ability and willingness to pay for protection. The expected net effects of wildfire on hydrologic values in a watershed are proportional to the hydrologic potential values in the watershed in the absence of fire, the probability of fires occurring at different sizes and frequencies under various levels of protection in the area, and the effects of those fires on the hydrologic potential values. Expected effects of wildland fires on hydrologic values have been indexed by 11 hydrologic parameters of floods, sedimentation, and water supply. Coefficients and watershed attributes from 10 multiple-regression models are used to distribute measured hydrologic parameters throughout each watershed. Other coefficients are used with present fire condition and fire frequency to estimate changes in the hydrologic parameters for four fire conditions: unburned, 1% average annual burn, after a 100% burn, and after a burn of 10,000 acres (3900 ha). Application is illustrated for north coastal, Sierra Nevada, and southern California watersheds. (Moore-SRC) W83-00306

#### HIGH PLAINS-OGALLALA AQUIFER STUDY, NEW MEXICO -- ECONOMIC IMPACTS, New Mexico State Univ., Las Cruces. Dept. of Agricultural Business.

R. R. Lansford.

In: *Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the High Plains, April 1-2, 1982. WRRI Report No 145, May 1982, p 47-68, 10 Fig, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.*

Descriptors: \*Water management, \*Resources management, \*Economic impact, \*Aquifer management, \*Aquifer systems, Water demand, Water shortage, Water supply, Irrigation programs, Irrigation effects, Crop production, Population dynamics, Model studies, Linear programming, Input-output analyses, \*New Mexico, \*Ogallala Aquifer.

Extensive exploitation of New Mexico's High Plains groundwater resources has taxed supplies to the extent that some irrigated areas have ceased production and other economic activities are threatened. The purpose of this study was to estimate the economic impacts of several conditions over a 40-year planning horizon. This article summarizes the on-farm and regional impacts for two sub-regions of the High Plains area. An aggregate linear programming model was designed to maximize returns to land and management from crop and livestock enterprises and an input/output model was used to evaluate regional economic impacts resulting from alternative management strategies, i.e., voluntary water demand reduction, mandatory supply reduction, and augmentation. Crop acreage in the Northern Plains is expected to increase steadily by county and under all management strategies; no irrigated areas are expected to stop production. In the Southern area, significant shifts from irrigated to dryland production are expected. Cropping patterns will be affected more in the Southern than the Northern areas because of water shortages. Cotton and alfalfa acreage is expected to increase while grain sorghum declines. In the North, water applications per acre for all crops except pasture are expected to decline due to increasing field efficiency while in the South reductions are expected due to water shortages. Gross output is expected to increase sporadically from \$2,384 million in 1977 to \$2,704 million in 2020. Total employment will vary but is expected to be 32,248 in 1977, 69,646 in 1985, and decreasing to 32,211 in 2020. Baseline population is expected to go from 136,284 in 1977 down to 108,481 in 2020. (Atkins-Omniplan) W83-00308

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#### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

#### LUMP SUM TAX LOSS REIMBURSEMENT UNDER THE THAMES RIVER FLOOD CONTROL COMPACT, Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.

For primary bibliographic entry see Field 6B. W83-00005

#### 6D. Water Demand

##### THE NATION'S WATER,

K. McCray.  
Water Well Journal, Vol 36, No 7, p 48-52, July, 1982.

Descriptors: \*Water supply, \*Water management, Groundwater, Aquifers, Irrigation, Water pollution, Prediction, Forecasting, Water demand, Water use, Water shortage.

The state of the nation's water is examined in a sampling of recent newspaper reports from different regions of the country. In the Midcontinent concern about water depletion prevailed in articles about renewal of irrigation permits, secondary sources for municipal supplies, new wells drilled during drought, and low levels in Texas' Edwards aquifer. In the Northeast the three New York reservoirs of the Delaware River Basin Commission were at 56% of capacity in February 1982. Salt intrusion in the Delaware River reached within a few miles of contaminating Camden wells. Water levels in Long Island's lakes and ponds will drop during the next 8 years. Rhode Island's governor favored water conservation over development of new supplies. In the Southeast, voluntary water conservation was suggested in South Florida, groundwater levels are declining along Florida's east coast, and water shortages could affect electricity production. A lack of data on groundwater resources in Tennessee is a serious problem. In the West water reuse is in the news in Los Angeles and Orange County; Senate Bill 200, authorizing the Peripheral Canal and augmentation of the state's water facilities, was due for a vote in June, 1982. Applications for water rights impeded existing domestic well supplies in Colorado. In the Great Lakes states drought plans were being developed for Illinois. Tapping Lake Michigan by Chicago suburbs not near the lake was condemned as expensive. Kalamazoo, Michigan, is counting on groundwater as supplies for the foreseeable future. Abundant water will be an even larger factor in the development of Ohio's industry. Projections for Wisconsin are increases in agricultural use and decreases in industrial use. However, groundwater pollution by nitrates from fertilizers is being detected in some Wisconsin wells. (Cassar-FRC) W83-00004

#### THE OGALLALA-HALF FULL OR HALF EMPTY.,

K. McCray.  
Water Well Journal, Vol 36, No 7, p 53-62, July, 1982. 5 Fig.

Descriptors: \*Agriculture, \*Aquifer management, \*Economic aspects, Water management, \*Ogallala Aquifer, High Plains Aquifer, \*Texas, Soil erosion, Pumping, Wells, Planning, Water supply, Water consumption, Water policy, Water conservation, Water shortage, Water demand, Water table decline, Groundwater mining, \*Groundwater depletion, Groundwater irrigation, Groundwater management, Irrigation efficiency.

The Ogallala Aquifer is an irregular unconfined aquifer within a 400 mile wide and 800 mile long area from South Dakota to Texas, including small sections of Colorado, Kansas, Nebraska, New Mexico, and Wyoming. Its 1 quadrillion gal of water are vital to agriculture and to the 2 million people living in the region. A survey indicates that 5% of the entire aquifer has been drained at a rate of 14 million acre-feet per year. The saturated thickness has declined more than 10% under a fourth of the total aquifer area. The greatest well level declines, 200 ft, have been in Floyd County, Texas. Average depletions are: Nebraska, 1%; Kansas, 8%; New Mexico, 16%. Within 25 years Colorado's share of the Ogallala will be 40% depleted. There are differing opinions on the future of agriculture in the Ogallala region. Since less water will be available, it is expected that agricultural patterns will change. The beef cattle industry will shift from Texas and Oklahoma to Nebraska and Kansas; Texas and New Mexico will grow cotton and wheat. Consequences of a switch to dry farming may include great increases in erosion. Suggestions for improving water management are conjunctive water use, land leveling, skip row irrigation, night-time watering, improved sprinklers, demand watering, tax incentives, weather modification, artificial recharge, and proper well design and operation. An extensive system of 280 ft wide canals to tap rivers in Missouri and Arkansas has been proposed. (Cassar-FRC) W83-00017

#### 6E. Water Law and Institutions

##### LAW,

Virginia Water Resources Center, Blacksburg.  
W. R. Walker.

Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 513-519, June, 1982. 55 Ref.

Descriptors: \*Literature reviews, \*Water law, \*Regulations, \*Reviews, Water rights, Legislation, Wastewater treatment, Legal aspects, Judicial decisions, Public participation, Nonpoint pollution sources, Common law, Permits, Oil shale, International law, Groundwater pollution, Landfills, Industrial wastewater, Municipal wastewater, Law enforcement.

Recent literature on water law was dominated by application, interpretation, and proposed revisions of federal legislation and the new philosophy of the Reagan administration on the role of government in pollution control. The Clean Water Act was challenged by some authors who felt that water quality goals should be decided on the watershed level rather than on the federal level. Difficulties of enforcing water pollution control laws against publicly owned treatment works were pointed out. Decisions in several cases indicated that public participation in the permit process is not necessary. Many EPA regulations were challenged in court cases. The Best Conventional Technology regulations were ruled invalid because a cost effectiveness analysis had not been prepared. The EPA was forced to consider ocean dumping as a viable sludge disposal alternative. History of and challenges to the Resource Conservation and Recovery Act (1976) were the subjects of several papers. Other aspects of water quality law discussed were: effectively dealing with instream uses to preserve water quality and serve other purposes, challenges to the Surface Mining and Reclamation Act of 1977, the impact of oil shale development on water quality, pollution problems which transcend national boundaries, public participation and protection of citizen's rights, suits concerning contamination or potential contamination of ground-

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

water supplies, pretreatment of industrial wastes, and hazardous waste landfills. (Cassar-FRC)  
W83-00165

#### U.S. GEOLOGICAL SURVEY FEDERAL-STATE PROGRAM,

Geological Survey, Reston, VA.

T. J. Buchanan, and B. K. Gilbert.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR1, p 37-45, March, 1982. 1 Fig, 3 Tab, 9 Ref.

Descriptors: \*Water use, \*Water supply, \*Water quality, \*Interagency cooperation, \*Data collections, \*Data acquisition, Data interpretation, Governmental interrelations, Water demand, Water management, Water resources development.

The U. S. Geological Survey Federal-State Cooperative Water Resource Program provides matching funds for joint water resources investigations by the Geological Survey and State and local agencies. The primary objectives of the program are to collect on a systematic basis data needed for the continuing determination and evaluation of the quantity, quality, and use of water resources and to conduct analytical and interpretive appraisals of the current availability and the physical, chemical and biological characteristics of surface and groundwater resources. While all projects must be proposed by the cooperating State or local agency, matching funds are made available in accordance with Federal guidelines with respect to needs and priorities. Since the Geological Survey performs most of the work on the projects, the program results in the development of a coherent and comparable national data base on water resources. Although total funding for the program is now more than \$80 million per year, many proposed projects cannot be funded. Sample projects include evaluation of landfill leachate plume effects on groundwater, development of mathematical models of aquifer response and of water quality models, investigation of pollution sources, and development of estimates of flood heights. Water data and investigation results are disseminated through reports, maps, computerized information services, and other forms of public releases. (Carroll-FRC)  
W83-00201

#### THE FLIGHT OF AMERICAN CITIZENS INJURED BY TRANSBOUNDARY RIVER POLLUTION,

D. C. Arbitribit.

Ecology Law Quarterly, Vol 8, No 2, p 339-370, 1979. 190 Ref.

Descriptors: \*Liability, \*International law, \*Legal aspects, Judicial decisions, Canada, Powerplants, Water pollution, Jurisdiction, Torts, Treaties, Water law, Rivers, Boundary Waters Treaty, International Joint Commission, Foreign Sovereign Immunities Act, Coal mining, Diversion, Water quality.

Legal remedies available to American citizens suffering damages from pollution originating in Canada are described. Ineffective measures include direct action against Canadian polluters, the provisions of the Boundary Waters Treaty, and the International Joint Commission. One possibility for recovering damages is the Foreign Sovereign Immunities Act of 1976. The thesis of this paper is that foreign nations have a duty to avoid transboundary pollution and to prevent private parties from causing transboundary pollution. A suit under this act would give American citizens a means to enforce this duty against the Canadian government. The suit would be based on a tort duty imposed by international law and derived from customary international law principles and the Helsinki Rules. Several proposed potentially-polluting projects are discussed. A massive coal-fired power station recently completed in Saskatchewan and a coal mining operation in British Columbia threaten Montana plains and wilderness regions, including the Flathead River and Lake. Conversely, the Garrison Diversion Unit, a proposed irrigation project, threatens the quality of water entering Canada from the Souris River, North Dakota. Sev-

eral related court cases and their results are reviewed. (Cassar-FRC)  
W83-00209

THE CLEAN WATER ACT'S SECTION 404 PERMIT PROGRAM ENTERS ITS ADOLESCENCE: AN INSTITUTIONAL AND GRAMMATICAL PERSPECTIVE, Lewis and Clark Law School, Portland, OR. For primary bibliographic entry see Field 5G. W83-00210

#### ANALYSIS OF LEGAL AND INSTITUTIONAL ARRANGEMENTS AFFECTING WATER ALLOCATION AND USE IN NEBRASKA,

Nebraska Univ.-Lincoln. Coll. of Law.

N. W. Thorson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108548, Price codes: A03 in paper copy, A01 in microfiche. Nebraska Water Resources Center Completion Report, Nebraska University, Lincoln, July, 1982. 44 p. OWRT A-052-NEB(1), 14-34-0001-9029.

Descriptors: \*Institutional constraints, \*Legal aspects, \*Water rights, \*Water allocation, \*Water use, \*Nebraska, Water policy, Water planning, Resource allocation, Riparian rights, Interstate compacts, Federal jurisdiction, Political aspects, Groundwater management, Policy making, Administrative decisions, Public policy.

Selected water rights issues were examined to assess the strengths/weaknesses of existing law, the needs/opportunities foregone under existing law, and alternative potential legislative policy positions which might be adopted in light of the identified needs/opportunities. Eight separate areas were analyzed in coordination with the Nebraska State Water Planning and Review Process: preferences in water use; diffused surface water drainage; beneficial use; groundwater property rights; water right adjudications; intergrating riparian and appropriative rights; surface water rights transfers; and interstate water uses/conflicts. Some 135 policy alternatives/sub-alternatives were developed and analyzed with the eight study areas. Major deficiencies in current law were identified. These included: an inflexible preference system conflicting with economic reality; critical terms unclearly defined under current law; confusing/unpredictable rules governing use/disposition of diffused surface waters; inadequate urban runoff control; lack of systematic effort to protect critical wetlands; legal uncertainty of the nature/scope of groundwater property rights; lack of procedure to adjudicate Federal/Indian water rights. (Zielinski-MAXIMA)  
W83-00250

#### WATER LAW PRIMER,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.

W. E. Cox.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR1, p 107-122, March, 1982. 25 Ref.

Descriptors: \*Water law, \*Legal aspects, \*Water use, \*Water pollution control, Groundwater management, Groundwater pollution, Surface water, Surface drainage, Watercourses, Water rights, State jurisdiction.

An overview of legal principles controlling the use and development of water resources is presented. The overview is designed primarily for use by engineers and others who do not have a background in water law but who need a concise treatment of basic issues. While laws pertaining to the allocation of water resources have generally originated at the State level, Federal laws have a greater role in the protection of water quality. With respect to watercourse law, which applies to water in streams and lakes, the two major doctrines are the riparian doctrine, which is dominant in the eastern United States, and the doctrine of prior appropriation, which is dominant in the west. There are four doctrines which are generally recognized with respect to ground water use: absolute

ownership, reasonable use, correlative rights, and appropriative rights. The three major doctrines which have been developed to deal with diffused surface water drainage are the common enemy doctrine, the civil law doctrine, and the reasonable use doctrine. Laws relating to pollution of watercourses, groundwater, and diffused water are also reviewed briefly. (Carroll-FRC)  
W83-00318

### 6G. Ecologic Impact Of Water Development

#### ENVIRONMENTAL IMPACT OF LARGE HYDROELECTRIC PROJECTS ON TROPICAL COUNTRIES,

Texas Univ. Health Science Center at Houston. School of Public Health.

F. Szekely.

Water Supply and Management, Vol 6, No 3, p 233-242, 1982. 3 Tab, 19 Ref.

Descriptors: \*Dam effects, \*Social impact, \*Water resources development, \*Hydroelectric power, Dams, Environmental effects, Ecological effects, Erosion, Human diseases, Developing countries, Aquatic weeds, Public health, Water quality, Water supply.

The effect of large hydroelectric plants on the environment in underdeveloped countries is examined. The construction of hydroelectric dams produces social impacts through the displacement of local populations without due compensation. Tropical diseases arising from the operation of high dams impose a social cost upon the communities in close proximity to the project. These diseases arise due to unsuitable living conditions and lack of sanitation as well as from the alteration of the natural ecological cycle through the introduction of a body of water. Schistosomiasis is one of the diseases most commonly associated with the operation of large dams located in tropic regions. The Chinese example in handling the snail-host aspect of schistosomiasis is a proper path to follow in handling the negative impacts of resource development. This campaign against schistosomiasis included making the snail's habitat uninhabitable for the mollusk, properly disposing of human wastes, maintaining proper water supplies, localizing infected individuals for treatment, and starting a mass education program. Other negative environmental effects are also noted. Problems of aquatic weed overgrowth already exist in several dams in Mexico. Erosion often takes place at the mouth of rivers whose waters have been harnessed for hydroelectric power production. As a possible solution, a new type of development (ecodevelopment) is recommended. This plan advocates the rational use of natural resources while meeting the needs of the population and balancing the interrelation between man and the environment. (Geiger-FRC)  
W83-00010

#### THE ECOLOGY OF THE MANGROVES OF SOUTH FLORIDA: A COMMUNITY PROFILE,

Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

W. E. Odum, C. C. McIvor, and T. J. Smith, III. Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/24, January 1982. 154 p, 18 Fig, 10 Tab, 353 Ref, 5 Append.

Descriptors: \*Florida, \*Mangrove swamps, \*Ecosystems, \*Natural resources, \*Wildlife habitats, Environmental effects, Coastal marshes, Salinity, Water pollution effects, Dikes, Floods, Tidal effects, Salinity, Wetlands, Particulate matter, Ecological distribution.

Based upon a compilation of data from published and unpublished sources, the community structure and ecosystem processes of the mangrove forests of south Florida are described in detail. It is concluded that mangrove forests, which cover between 430,000 and 500,000 acres (174,000-202,000 ha) in Florida, are a resource of great value and should be protected and preserved whenever possible. Four major factors appear to limit the distribution of mangroves and determine the extent of

## RESOURCES DATA—Field 7

### Network Design—Group 7A

mangrove ecosystem development. These factors include: climate; salt water; tidal fluctuation; and substrate. In general, the surface waters associated with mangroves are characterized by: a wide range of salinities, from virtually fresh water to above 40 ppt; low macronutrient concentrations; relatively low dissolved oxygen concentrations; and frequently, increased water color and turbidity. Man-induced destruction of mangrove forest in Florida has occurred in various ways, including outright destruction and land filling, diking and flooding, through introduction of fine particulate material which clogs aerial roots, and pollution damage, particularly oil spills. Total loss statewide is probably in the range of 3 to 5% but losses in specific areas are appreciable. At no cost to man, mangrove forests provide habitat for valuable birds, mammals, amphibians, reptiles, fishes, and invertebrates and protect endangered species, at least partially support extensive coastal food webs, provide shoreline stability and storm protection, and generate aesthetically pleasing experiences. (Moore-SRC)  
W83-00093

#### AN ALTERNATIVE TO THE PERIPHERAL CANAL, California Univ., Davis. Dept. of Civil Engineering.

G. T. Orlob.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR1, p 123-141, March, 1982. 7 Fig, 2 Tab, 5 Ref.

Descriptors: \*Water transfer, \*Estuaries, \*Deltas, Simulation analysis, Mathematical models, Water quality, Saline water intrusion, Water conveyance, \*Alternative planning, \*California, Sacramento River, San Joaquin River.

The present system of water conveyance through the Sacramento-San Joaquin Delta in California is not adequate to meet future export requirements and to maintain desired water quality. State agencies and water delivery contractors in Southern California favor construction of the proposed 42-mile-long Peripheral Canal, which would convey project water around the estuary. However, Northern Californian water interests oppose this project, preferring an 'open' water transfer alternative. Mathematical models of the Delta estuarial system were used to compare the hydrodynamic and water quality responses of the estuary under conditions of future operation for the present water transfer method, for the peripheral canal, and for an alternative open transfer system. The simulation analysis indicated that all three alternatives could control salinity intrusion in the western Delta. While the peripheral canal was shown to be capable of maintaining net seaward flow in most channels, both the open water alternative and the present system caused 'upstream' flow in channels leading to export pumps due to their through-Delta nature. Analysis of water quality responses indicated that the use of the present system could be expected to result in unacceptable conditions in the western and southern channels, while the peripheral canal would allow significant degradation in the extreme southern delta channels. The alternative open water transfer plan resulted in generally excellent water quality in the northern, central, and southern Delta. The alternative plan appears to be capable of meeting water quality objectives throughout the Delta while assuring delivery to the pumping stations of water of a quality adequate for all intended uses in service areas to the south. (Carroll-FRC)  
W83-00193

#### THE ROLE OF HYDROLOGIC VARIABILITY IN COMPLYING WITH REGULATORY ENFORCEMENT STANDARDS FOR THE REHABILITATION OF SURFACE-MINED COAL LANDS, Arizona Univ. Tucson. Dept. of Hydrology and Water Resources.

L. H. Hekman, Jr., D. R. Davis, and M. M. Fogel. Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108316. Price codes: A05 in paper copy, A01 in microfiche.

Completion Report, June, 1982. 84 p, 10 Fig, 5 Tab, 64 Ref, 3 Append. OWRT B-073-ARIZ(1), 14-34-0001-9056.

Descriptors: \*Hydrologic cycle, \*Legal aspects, \*Land reclamation, \*Coal mining, \*Model studies, Hydrologic data, Hydrologic properties, Hydrologic budget, Regulations, Enforcement, Rehabilitation, Regeneration, Surface runoff, Computer models, Mathematical models, Land management, Land resources, Land development, Strip mines, Coal mines, Coal, Precipitation.

It was determined that hydrologic variability affects surface mining regulation compliance, principally through precipitation. Specifically, studies of sediment control, revegetation, and aquifer testing show regulations which do not consider that the inherent natural/sample/model uncertainties can be inefficient both economically and environmentally. A consideration of the uncertainty in the regulatory process requires both objective and subjective information. This includes uncertainty quantification, a precise knowledge of regulatory goals and their relative importance, and a criterion to resolve the uncertainty. However, there is a paucity of such information for surface mining regulations. While the uncertainties and their effects may be quantified, the second and third types of information are neither stated in the Surface Mining Act (SMA) or the regulations, nor uniquely implied in legislative/regulatory history. However, politically, the SMA and the regulations may be considered as efficient, due to the concerns of the time. In essence, proper attention to the scientific aspects alone, can improve regulatory effort efficiency in many individual cases. Hence, variability in the natural hydrologic regime and parameter/models uncertainty used to describe this regime has led to inefficient surface mining regulatory compliance as applied to semi-arid areas. Methods were developed for studying/analyzing the uncertainty and its effect. (Zielinski-MAXIMA)  
W83-00223

#### FINAL ENVIRONMENTAL IMPACT STATEMENT OF THE WHITE RIVER DAM PROJECT, Bureau of Land Management, Vernal, UT.

Report, May 1982. 389 p, 38 Fig, 30 Tab, 191 Ref, 12 Append.

Descriptors: \*Environmental Impact Statement, \*Dam effects, \*Environmental effects, \*White River, \*Water resources development, \*Hydroelectric plants, \*Utah, Reservoirs, Salinity, Colorado river, Fish populations, Oil shale, Energy resources development, Fish conservation, Cost analysis.

The environmental consequences of five alternatives designed to supply water for energy development, including oil shale, in Uintah County, Utah, were assessed. The alternatives include; construction of the White River Dam, reservoir, and hydroelectric plant; No Action; pumping from the White River and augmenting from Hell's Hole Canyon Dam; pumping from Green River; pumping from White River and supplementing with water pumped from the Green River. The White River Dam would create a 11.7 mile long reservoir with 1980 surface acres. Also proposed are a 15 MW hydroelectric power plant, power transmission system, recreational facilities, and access roads. Three species of rare endemic fish (Colorado squawfish, humpback chub, and bonytail chub) have been observed in portions of the White River in Utah and are listed as endangered. However, with implementation of the operation procedures and conservation measures recommended in the Fish and Wildlife Biological Opinion, the White River Dam Project would not likely jeopardize the continued existence of the endangered fishes. A depletion of 75,000 acre-feet of water from the White River would result in an increase in salinity of Imperial Dam on the Colorado River of 4.1 mg/l. A rough water supply cost comparison indicates that the White River Dam and Reservoir would be the least expensive alternative, and this alternative would be the only producer of energy. There are

still unresolved issues regarding future water allocations in the White River. (Moore-SRC)  
W83-00297

## 7. RESOURCES DATA

### 7A. Network Design

#### WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN NEW MEXICO, FISCAL YEAR 1980, Geological Survey, Albuquerque, NM. Water Resources Div.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$5.25 in paper copy, \$3.50 in microfiche. Open-File Report 82-267, February 1982. 36 p, 5 Fig, 24 Ref. (Compiler, R. R. White).

Descriptors: \*Data collections, \*Groundwater, \*Surface water, Network design, Available water, Water quality, Publications, \*New Mexico.

This is the third in a series of annual reports in which the program of the New Mexico District, U.S. Geological Survey, Water Resources Division, is summarized. This report, which is for fiscal year 1980, may be of use to cooperating agencies and to the users of water data in that it summarizes and gives the status of the basic data-collection program and all current studies of the Water Resources Division in New Mexico. The New Mexico District, along with other Federal and State agencies, shares in the responsibility for the appraisal of the quantity, quality, and distribution of surface- and ground-water resources of the State of New Mexico. During fiscal year 1980, the District had 28 active projects, had released 24 reports, and had answered hundreds of requests for water-related information. (USGS)  
W83-00073

#### U.S. GEOLOGICAL SURVEY FEDERAL-STATE PROGRAM, Geological Survey, Reston, VA.

For primary bibliographic entry see Field 6E.  
W83-00201

#### DESIGN OF MONITORING STUDIES FOR PRIORITY POLLUTANTS, E.V.S. Consultants, Ltd., Vancouver (British Columbia).

P. M. Chapman, G. P. Romberg, and G. A. Vigers. Journal of the Water Pollution Control Federation, Vol 54, No 3, p 292-297. March, 1982. 1 Fig, 2 Tab, 2 Ref.

Descriptors: \*Monitoring, \*Pollutant identification, Bioaccumulation, Accumulation, Toxins, Chemical compounds, Sediments, Biota, Water pollution, Data collections, Chemical analysis, Networks.

The U.S. Environmental Protection Agency has published a list of 65 classes of toxic chemicals, numbering 126 compounds, for which the agency intends to develop discharge control standards. In order to design and implement financially and scientifically credible surveillance programs for these priority pollutants, it is first necessary to develop a selective rationale to reduce specific programs to manageable proportions. The current state of knowledge regarding the fate and effects of the priority pollutants has been summarized in a convenient tabular form which characterizes compounds on the basis of persistence, accumulative capacity, and volatility and which identifies the environmental compartment (water, sediment, or biota) of major concern for each compound. Although the rationale used in setting priorities for these pollutants and the environmental compartments may be oversimplistic for some situations, the approach provides a basic rational framework for designing and initiating an environmental monitoring program for the pollutants. The information should permit the design of individual monitoring programs in a cost-effective manner based on sound scientific principles. (Carroll-FRC)  
W83-00321

## Field 7—RESOURCES DATA

### Group 7B—Data Acquisition

#### 7B. Data Acquisition

**MANUAL FOR LEVELING AT GAGING STATIONS IN NORTH CAROLINA,**  
Geological Survey, Raleigh, NC. Water Resources Div.  
N. O. Thomas, and N. M. Jackson, Jr.  
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$5.25 in paper copy, \$3.50 in microfiche. Open-File Report 81-1104, October 1981. 37 p, 13 Fig.

Descriptors: \*Training, \*Data collections, \*Stream gages, \*Water level, Measuring instruments, Gaging stations, Civil engineering, Technology, \*North Carolina.

This manual was prepared to serve several purposes in the U.S. Geological Survey North Carolina District. This manual sets forth District policy as to frequency of levels, accuracy criteria, procedures for checking the datum and setting of the various types of gages, general rules to follow in establishing the original datum of a gage, and contains sample notes to be used as guides in level notekeeping. The manual also serves as a training tool in that the reasoning behind District policy is explained and reasons are given for following the recommended techniques to assist in a better understanding of the purpose of levels and maintaining gage datum. (USGS) W83-00065

**ADAPTATION OF THE ILLUDAS MODEL TO A DESK-TOP COMPUTER,**  
Canada Centre for Inland Waters, Burlington (Ontario).  
J. Marsalek.  
National Water Research Institute, Technical Bulletin No 120, 1981. 45 p, 7 Fig, 22 Tab, 5 Ref, 1 Append.

Descriptors: \*Computers, \*Computer programs, \*Urban runoff, \*Urban drainage, \*Hydrograph analysis, Computer models, Model studies, Mathematical studies, Engineering, Design criteria, Data interpretation, Data processing, Runoff forecasting, Runoff, Runoff rates, Runoff volume, Mathematical models, Hyetographs, Statistical analysis, Rainfall, Sensitivity analysis.

Computer models for engineering design use require correct verification to establish reliable results; such verification is provided for a new technique that clearly shows that reliable results are obtainable for a modified urban runoff model (Illinois Urban Drainage Area Simulator; ILLUDAS) by using lower-cost desk-top computers. The results can be used wherever runoff rates and quantities must be computed from rainfall events. The standard version of the ILLUDAS model written for the IBM 360/75 computer was modified and adapted to a Hewlett-Packard 9830 desk-top computer. The modified model was verified on a test catchment and subjected to a sensitivity analysis. For a small catchment with simple flow routing, the modified model performed equally as well as conventional models requiring large computer systems. The modified model not only retained all of the features of the original model, but was further expanded for a number of new features. These new features included: interactive program operation, multiple rainfall hyetographs, input of hydrographs from upper reaches, optional calculation of inlet times, storage of flows on street surface, approximately analysis of pressurized flow in sewers, dry weather flow, and statistical analysis of simulated/observed hydrographs. (Zielinski-MAXIMA) W83-00081

#### 7C. Evaluation, Processing and Publication

**WATER RESOURCES DATA, LOUISIANA, WATER YEAR 1981—VOLUME 2. SOUTHERN LOUISIANA.**  
Geological Survey, Baton Rouge, LA. Water Resources Div.

Available from the National Technical Information Service, Springfield, VA 22161 as Water-Data Report LA-81-2, 1981. 327 p, 18 Fig.

Descriptors: \*Hydrologic data, \*Surface water, \*Groundwater, \*Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, \*Louisiana, Southern Louisiana.

Water resources data for the 1981 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report, in three volumes, contains records for water discharge at 81 gaging stations (including stage for 76 of these stations); stage only for 37 gaging stations and 10 lakes; contents for 1 reservoir; water quality for 142 surface-water stations (including 35 gaging stations), 27 miscellaneous sites, 10 lakes, and 286 wells; and water levels for 679 observation wells. Also included are data for 250 crest-stage and flood-profile partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States are also included in this report. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (USGS) W83-00057

**CARROLL COUNTY GROUND-WATER INFORMATION: WELL RECORDS, SPRING RECORDS, AND CHEMICAL-QUALITY DATA.**  
Geological Survey, Towson, MD. Water Resources Div.  
Maryland Geological Survey, Water Resources Basic Data Report No 12, 1981. 251 p, 29 Fig, 4 Tab, 14 Ref. (Compiled by J. T. Hilleary and J. M. Weigle).

Descriptors: \*Groundwater, \*Water quality, \*Data collections, \*Chemical analysis, Springs, Water wells, Well data, Well yield, Aquifer characteristics, Water sampling, Sites, Maps, \*Maryland, Carroll County, Piedmont Province. W83-00061

This report is a compilation of water-well records, spring records, chemical-quality data and water-use data for Carroll County, Maryland. The report contains records of 3,224 water wells, 75 springs, and 159 chemical analyses of ground water. (USGS) W83-00058

**GEOHYDROLOGY OF SOUTHWESTERN KANSAS,**  
Geological Survey, Lawrence, KS. Water Resources Div.

E. D. Gutentag, D. H. Lobmeyer, and S. E. Slagle. Univ. of Kansas Publ. Lawrence, Kans. Kansas Geological Survey, Irrigation Series 7, 1981. 73 p, 14 Fig, 3 Plates, 4 Tab, 48 Ref.

Descriptors: \*Hydrologic data, \*Groundwater potential, \*Geohydrology, \*Aquifer characteristics, Irrigation wells, Pumping, Water level, Water use, Available water, Water quality, Chemical analysis, Hydrologic cycle, Maps, \*Southwestern Kansas, High Plains, Arkansas River, Cimarron River.

The study area covers about 8,900 square miles and includes Finney, Grant, Gray, Hamilton, Haskell, Kearny, Meade, Morton, Seward, Stanton, and Stevens Counties, Kansas. Normal annual precipitation near the center of the area is 19.45 inches. About 75% of the area is underlain by sufficient saturated thickness of unconsolidated aquifer to yield water for irrigation. Water in the aquifer ranges from a calcium bicarbonate type with moderate salinity, suitable for most purposes, to a sodium chloride type, too highly saline for most purposes. Water available for pumping is estimated to be about 105 million acre-feet (1975). Recharge from precipitation is calculated to be 210,000 acre-feet per year. The amount removed from storage

since 1940 is about 14 million acre-feet. About 1.4 million acres were irrigated from about 7,000 wells in 1975. The net withdrawal rate in 1974 is estimated to be 1.7 to 2.2 million acre-feet per year. (USGS) W83-00059

**LOW-FLOW CHARACTERISTICS AND FLOW DURATION OF NEW JERSEY STREAMS,**  
Geological Survey, Trenton, NJ. Water Resources Div.

B. D. Gillespie, and R. D. Schopp. Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$22.00 in paper copy, \$3.50 in microfiche. Open-File Report 81-1110, January 1982. 164 p, 15 Fig, 10 Ref.

Descriptors: \*Streamflow, \*Low flow, \*Flow characteristics, \*Flow duration, Surface water, Gaging stations, Sites, Discharge measurement, Base flow, Frequency analysis, Data collections, \*New Jersey.

Low-flow frequency and flow-duration data for 400 continuous-record and partial-record gaging stations in New Jersey are tabulated in this report. The amount of data analyzed at each site varies from the complete daily discharge record for continuous-record gaging stations, some of which have been in operation for over 50 years, to limited discharge measurements for partial-record sites. Daily discharges for continuous-record stations with 7 or more years of record were analyzed by digital computer. From these computer summaries, low-flow frequency tables for all gaging stations on unregulated streams with 10 or more years of record were tabulated. Flow-duration tables were also compiled for streams with at least 7 years of streamflow records. For continuous-record gaging stations with less than 10 years of record, for highly regulated streams, and for partial-record sites, only observed or estimated annual minimum mean discharges for 7 consecutive days with recurrence intervals of 2 and 10 years are given. (USGS) W83-00051

**REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS-OKLAHOMA, 1980 WATER YEAR,**  
Geological Survey, Little Rock, AR. Water Resources Div.

For primary bibliographic entry see Field 4A.

W83-00063

**INSTALLATION AND SAMPLING OF OBSERVATION WELLS AND ANALYSES OF WATER FROM THE SHALLOW AQUIFER AT SELECTED WASTE-DISPOSAL SITES IN THE MEMPHIS AREA, TENNESSEE,**  
Geological Survey, Memphis, TN. Water Resources Div.

For primary bibliographic entry see Field 5B.

W83-00066

**GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SOUTH FALLSBURGH-WOODBOURNE AREA, SULLIVAN COUNTY, NEW YORK,**  
Geological Survey, Albany, NY. Water Resources Div.; and New York State Geological Survey/State Museum, Albany.

H. R. Anderson, R. J. Dineen, W. G. Stetz, and J. L. Belli. Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$17.00 in paper copy, \$3.00 in microfiche. Open-File Report 82-112, 1982. 6 sheets, 5 Ref.

Descriptors: \*Geologic mapping, \*Groundwater, \*Aquifers, \*Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, \*New York, Sullivan County, Soil Permeability.

This report is the ninth in a series of map sets depicting geohydrologic conditions in selected

## Evaluation, Processing and Publication—Group 7C

aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together the maps provide a comprehensive overview of a major valley-fill aquifer in southeastern Sullivan County. The maps include surficial geology, geologic sections, aquifer thickness, water-infiltration potential of soil zone, potentiometric surface elevations, well yields, and land use. The valley-fill deposits consist of alluvial silt and sand, glacial outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities whereas the till, silt, and clay deposits have relatively low permeabilities. Water-table conditions prevail in unconfined sand and gravel whereas artesian conditions prevail within sand and gravel confined by silty deposits. The aquifer is recharged throughout, where the land surface is most permeable and is greatest along the margin of the valley, where runoff from the hillsides is concentrated. The use of land overlying the aquifer is predominantly commercial, agricultural, and residential with lesser industrial uses. (USGS) W83-00069

## SELECTED HYDROLOGIC AND CLIMATOLOGIC DATA FROM THE PRAIRIE DOG CREEK BASIN, SOUTHEASTERN MONTANA, WATER YEAR 1980

Geological Survey, Helena, MT. Water Resources Div.

L. E. Cary, and J. D. Johnson.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$10.00 in paper copy, \$3.50 in microfiche. Open-File Report 82-273, March 1982. 74 p, 2 Fig, 42 Tab, 4 Ref.

Descriptors: \*Data collections, \*Hydrologic data, \*Climatic data, Precipitation, Air temperature, Relative humidity, Solar radiation, Wind, Soil temperature, Soil water, Streamflow, Water quality, Chemical analysis, Suspended sediments, Model studies, \*Montana.

Hydrologic and climatologic data are being collected in a 25-square-mile (65-square-kilometer) basin in southeastern Montana to provide a base for development, calibration, and verification of a precipitation-runoff model. The study area and data-collection stations within the area are shown on a map. A summary of data collected at each station during the second year, beginning in October 1979, is provided in tables. The data include precipitation, snow depth and water content, air temperature, relative humidity, wind speed and direction, solar radiation, soil temperature and moisture, stream discharge, chemical analyses of water, and suspended sediment. (USGS) W83-00074

## APPROXIMATELY WATER-LEVEL CHANGES IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS 1977-82 AND 1981-82, AND MEASURED COMPACTION 1973-82, IN THE HOUSTON-GALVESTON REGION, TEXAS

Geological Survey, Houston, TX. Water Resources Div.

J. L. Strause, and C. E. Ranzau, Jr.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$5.00 in paper copy, \$5.50 in microfiche. Open-File Report 82-328, March 1982. 5 Sheets.

Descriptors: \*Aquifers, \*Groundwater, \*Wells, \*Water level fluctuations, \*Compaction, Land subsidence, Maps, \*Texas, Chicot aquifer, Evangeline aquifer, Galveston County, Harris County.

This report consists of: (1) Four maps that present data on water-level changes during 1977-82 and 1981-82 in the Chicot and Evangeline aquifers and (2) one set of graphs that present data on the compaction of subsurface materials for 1973-82. During these periods, ground-water pumping decreased in Galveston County and eastern Harris County and increased in northern and western Harris County. (USGS) W83-00075

## SELECTED HYDROGEOLOGIC DATA FROM SOUTHERN SWEET GRASS COUNTY, SOUTH-CENTRAL MONTANA

Geological Survey, Helena, MT. Water Resources Div.

R. D. Feltis, and Wayne A. Wood.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$3.25 in paper copy, \$4.00 in microfiche. Open-File Report 82-265, February 1982. 12 p, 2 Fig, 1 Plate, 3 Tab.

Descriptors: \*Groundwater, \*Water quality, \*Hydrologic data, \*Water wells, Springs, Sites, Well data, Chemical analysis, Physical properties, Trace elements, \*Montana, Sweet Grass County.

Selected hydrogeologic data from Sweet Grass County south of the Yellowstone River have been compiled to show baseline ground-water conditions. Included are records from a 1981 onsite inventory of 94 water wells and 30 springs. Chemical analyses of water show the major cation and anion concentrations for 40 wells and 14 springs. Concentrations of 17 trace elements in water from 12 of the wells and 9 of the springs were determined by an argon coupled emission spectrometer. (USGS) W83-00076

## HYDROLOGIC DATA FOR URBAN STORM RUNOFF FROM NINE SITES IN THE DENVER METROPOLITAN AREA, COLORADO

Geological Survey, Lakewood, CO. Water Resources Div.

J. W. Gibbs.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$29.50 in paper copy, \$7.00 in microfiche. Open-File Report 81-682, 1981. 142 p, 1 Fig, 7 Plates, 84 Tab, 4 Ref.

Descriptors: \*Hydrologic data, \*Storm runoff, \*Rainfall-runoff relationships, \*Water quality, Data collections, Urban runoff, Retention, Reservoirs, Model studies, \*Colorado, Denver metropolitan area.

Urban storm-runoff data were collected April through September 1980, from nine urban runoff sites in the Denver metropolitan area, and are presented in this report. The sites consist of two single-family residential areas, two multi-family residential areas, one commercial area (shopping center), one mixed commercial and multi-family residential area, one native area (open space), and two detention ponds. Precipitation, rainfall-runoff, water-quality (common constituents, nutrients, common bacteria, solids, and trace elements) and basin-area data are necessary to use the U.S. Geological Survey's Distributed Routing Rainfall-Runoff Model, Version II. The urban storm-runoff data may be used to characterize runoff pollution loading for various land-use types in Denver and other semi-arid regions. (USGS) W83-00077

## WATER RESOURCES OF THE RINCON AND MESILLA VALLEYS AND ADJACENT AREAS, NEW MEXICO

Geological Survey, Albuquerque, NM. Water Resources Div.

C. A. Wilson, R. R. White, B. R. Orr, and R. G. Roybal.

New Mexico State Engineer Technical Report 43, 1981. 514 p, 19 Fig, 16 Plates, 14 Tab, 125 Ref.

Descriptors: \*Surface-groundwater relations, \*Hydrologic data, \*Water quality, \*Water supply, Water use, Surface irrigation, Irrigation effects, Return flow, Aquifers, Well data, Chemical analysis, \*New Mexico, Rincon Valley, Mesilla Valley, Rio Grande.

The Rincon and Mesilla Valleys of New Mexico extend from Caballo Reservoir to El Paso del Norte, west of El Paso, Texas. Water supplies for this area are obtained from the Rio Grande and from the saturated sediments filling the intermontane basins of south-central New Mexico. The two major aquifers are the Santa Fe Group of Miocene to middle Pleistocene age and flood-plain alluvium

of late Pleistocene and Holocene age. The flood-plain alluvium is recharged primarily from surface-water infiltration from the Rio Grande, irrigation canals, and irrigated fields. Recharge to the Santa Fe Group occurs primarily from downward infiltration of water from the flood-plain alluvium. Aquifer tests were conducted on 58 wells and test holes. Estimated transmissivities range from 1.3 to 21,100 feet squared per day. Average well yields are 1,050 gallons per minute in the Rincon Valley and 1,500 gallons per minute in the Mesilla Valley. Dissolved-solids concentrations in the flood-plain alluvium of the Rincon and Mesilla Valley are generally greater than 1,000 milligrams per liter. A freshwater zone, with dissolved-solids concentrations less than 1,000 milligrams per liter, underlies this thin, slightly saline zone along much of the Mesilla Valley. (USGS) W83-00078

## HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1973

Agricultural Research Center, Beltsville, MD. Hydrologic Data Lab.

J. B. Burford, J. L. Thurman, and R. T. Roberts. Agricultural Research Service Miscellaneous Publication No. 1420, July 1982. 408 p, 120 Fig, 300 Tab, 55 Ref.

Descriptors: \*Hydrologic data, \*Agricultural watersheds, \*Precipitation, \*Runoff, \*Flow discharge, Watersheds, Storm runoff, Air temperature, Rainfall intensity, Hyetographs, Hydrographs.

Selected hydrologic data are presented from 100 watersheds for 1973. Data are included on monthly precipitation and runoff for all the watersheds; annual maximum discharge and maximum volumes of runoff for intervals of 1, 2, 6, and 12 hours and 1, 2, and 8 days for 97 watersheds; daily precipitation for 99 watersheds; mean daily discharge for 100 watersheds; daily maximum and minimum air temperatures for 15 watersheds; and detailed information on one or more selected typical storm events for 88 watersheds. Information on selected storm events includes tabular data for antecedent rainfall and runoff; data on rainfall intensity and runoff for the event and on accumulated depth of rainfall and runoff; description of watershed conditions at the time of the selected events; and plotings of runoff hydrographs and rainfall histograms. For newly established watersheds, descriptions of watershed physical characteristics, instrumentation, land management, and recommended area of application of the results are given, as well as graphs and maps. (Moore-SRC) W83-00095

## HYDROLOGIC DATA FOR THE ALLUVIUM AND TERRACE AQUIFER OF THE BEAVER-NORTH CANADIAN RIVER FROM THE PANHANDLE TO CANTON RESERVOIR, NORTHWESTERN OKLAHOMA

Geological Survey, Oklahoma City, OK. Water Resources Div.

R. E. Davis, S. C. Christenson, and S. P. Blumer. Open-File Report 80-159, January 1981. 77 p, 1 Plate, 4 Tab, 3 Ref.

Descriptors: \*Data collections, \*Groundwater, \*Geohydrology, \*Aquifers, Water wells, Test holes, Springs, Chemical analysis, Water level, Low flow, \*Oklahoma.

The U.S. Geological Survey has collected data on Oklahoma's groundwater resources since 1934. The data in this report were collected as part of a study in cooperation with the Oklahoma Water Resources Board to evaluate the geohydrology of the alluvium and terrace aquifer of the Beaver-North Canadian River in northwestern Oklahoma. The data include records of approximately 900 wells, test-holes, and springs, results of chemical analyses of water from 30 wells tapping the aquifer, monthly water-level measurements for selected wells, and low-flow discharge measurements of the Beaver-North Canadian River and its tributaries. All of the data were collected in the field during the period 1977-79. (USGS) W83-00110

## Field 7—RESOURCES DATA

### Group 7C—Evaluation, Processing and Publication

**QUALITY OF SURFACE WATER AT SELECTED SITES IN THE SUWANNEE RIVER BASIN, FLORIDA, 1980,**  
Geological Survey, Tallahassee, FL. Water Resources Div.  
J. E. Coffin.

Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$15.00 in paper copy, \$3.50 in microfiche. Open-File Report 82-103, 1982. 107 p, 57 Fig, 18 Tab, 16 Ref.

Descriptors: \*Water quality, \*Surface water, \*River basins, Monitoring, Water sampling, Sites, Data collections, Chemical analysis, Hydrologic data, Water analysis, \*Florida, Suwannee River basin.

This report presents the results of analyses of water-quality samples collected from 14 surface-water sites in the Suwannee River basin in Florida from January through December 1980. The analyses of samples collected routinely included: nutrients, total organic carbon, and 5-day biochemical oxygen demand, bimonthly; and trace metals, annually. The array of constituents sampled was expanded in October 1978 at three of the original nine stations to provide quality-of-water information for streams draining an industrial area: Rocky Creek near Belmont, Hunter Creek near Belmont, and Swift Creek at Facil. Data collected at these three sites now include: major chemical constituents, six times per year: radium-226, two times per year; and trace metals, one time per year. These constituents are determined in addition to nutrients, total organic carbon, and bio-chemical oxygen demand which continue to be analyzed six times per year. All results of analyses of the water-quality samples collected from January through December 1980 remained within, or near, previously measured ranges and water-quality fluctuations were similar to those noted from data collected since 1971. (USGS) W83-00113

**MAP SHOWING THE POTENTIOMETRIC SURFACE OF THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND, SEPTEMBER 1981,**  
Geological Survey, Annapolis, MD. Water Resources Div.; and Geological Survey, Towson, MD. Water Resources Div.

F. K. Mack, J. C. Wheeler, and S. E. Curtin.  
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$1.00 in paper copy, \$3.50 in microfiche. Open-File Report 82-257, 1982. 1 Sheet.

Descriptors: \*Maps, \*Potentiometric level, \*AQUIFERS, \*Observation wells, Groundwater level, Coastal plains, \*Maryland, Magothy aquifer, Cone of depression.

The map is based on measurements from a network of 83 observation wells cased to the Magothy aquifer. Highest levels of the potentiometric surface, 59 to 60 feet above sea level, were measured near the outcrop-subcrop of the aquifer in topographically high areas of Anne Arundel and Prince Georges Counties. The surface slopes to the southeast to above sea level along much of the western shore of Chesapeake Bay. Three separate, distinct, and extensive cones of depression have developed in the potentiometric surface around the well fields of the city of Annapolis-Broadneck Peninsula area, town of Waldorf, and Chalk Point. Several square miles of each cone are below sea level, and, in some areas at Chalk Point and Waldorf, the cone is 40 to 50 feet below sea level. The network of wells was developed as part of the cooperative program between the U.S. Geological Survey, the Maryland Geological Survey, and the Maryland Energy and Coastal Zone Administration. (USGS) W83-00115

**GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SCHENECTADY AREA, SCHENECTADY COUNTY, NEW YORK,**  
Geological Survey, Albany, NY. Water Resources Div.

G. A. Brown, R. B. Moore, K. I. Mahon, and R. V. Allen.  
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$17.00 in paper

copy, \$3.00 in microfiche. Open-File Report 82-84, 1981. 6 Sheets, 8 Ref.

Descriptors: \*Geologic mapping, \*Groundwater, \*AQUIFERS, \*Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, \*New York, Schenectady County, Soil Permeability.

This report is the fourth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together the maps provide a comprehensive overview of the Schenectady aquifer, the principal aquifer in Schenectady County and the most heavily pumped aquifer in upstate New York. The maps include surficial geology, geologic sections, soil permeability, water-table altitude, aquifer thickness, estimated well yield, and land use. The maps are designed to enable planners to evaluate underground waste-disposal practices that could adversely affect the aquifer. (USGS) W83-00116

**GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE CORNING AREA, STEUBEN COUNTY, NEW YORK,**  
Geological Survey, Albany, NY. Water Resources Div.

T. S. Miller, J. L. Belli, and R. V. Allen.  
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$21.50 in paper copy, \$3.00 in microfiche. Open-File Report 82-85, 1982. 6 Sheets, 9 Ref.

Descriptors: \*Geologic mapping, \*Groundwater, \*AQUIFERS, \*Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, \*New York, Steuben County, Soil permeability.

This report is the seventh in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together, the maps provide a comprehensive overview of a major valley-fill aquifer in southeastern Steuben County. The maps include surficial geology, geologic sections, water-infiltration potential of soil zone, aquifer thickness, potentiometric-surface elevations, and land use. The valley-fill deposits consist of alluvial silt, sand, and gravel, glacial outwash (sand and gravel), till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities, whereas the till and silt deposits have relatively low permeabilities. Water-table conditions prevail in unconfined sand and gravel along the valley margin. Artesian conditions are found locally in sand and gravel confined under silt and clay in the middle of the valley. Recharge occurs nearly everywhere on the valley floor, but principally along the margin of the valley, where highly permeable land surface conditions exist, and runoff from the hillsides is concentrated. The use of land overlying the aquifer is a mixture of residential, commercial, agricultural, and industrial uses. (USGS) W83-00117

**WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1981—VOLUME 3. WESTERN NEW YORK.**

Geological Survey, Albany, NY. Water Resources Div.

Available from the National Technical Information Service, Springfield, VA 22161 as Water-Data Report NY-81-3, March 1982. 223 p, 5 Fig, 1 Tab.

Descriptors: \*Hydrologic data, \*Surface water, \*Groundwater, \*Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, \*New York, Western New York.

Water resources data for the 1981 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and

water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 85 gaging stations, stage only at 14 gaging stations, stage and contents at 6 gaging stations and 2 other lakes and reservoirs; water quality at 15 gaging stations, 4 quality of precipitation stations, and water levels at 19 observation wells. Also included are data for 62 crest-stage and 12 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 1 and 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in New York. (USGS) W83-00131

**WATER RESOURCES DATA FOR NORTH CAROLINA, WATER YEAR 1981.**

Geological Survey, Raleigh, NC. Water Resources Div.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-103432, Price codes: A21 in paper copy, A01 in microfiche. Water-Data Report NC-81-1, March 1982. 465 p, 6 Fig, 2 Tab.

Descriptors: \*Hydrologic data, \*Surface water, \*Groundwater, \*Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, \*North Carolina.

Water resources data for the 1981 water year for North Carolina consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 151 gaging stations, stage and contents for 24 lakes and reservoirs and stage only for one lake, water quality for 52 gaging stations and 6 miscellaneous sites, and water levels for 61 observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements in this report. The collection of water-resources data in North Carolina is a part of the National Water-Data System operated by the U.S. Geological Survey in cooperation with State, municipal, and Federal agencies. (USGS) W83-00132

**SOIL MAPS OF MONTANA,**  
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.

G. A. Neilson.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108431, Price codes: A02 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Bozeman, MWRRC Report No. 112, December 1980. 7 p, 4 Ref. ORWT A-091-MONT, 14-34-0001-8028.

Descriptors: \*Montana, \*Soil surveys, \*Maps, \*Topographic mapping, \*Graphical analysis, Soil types, Soil classification, Soil profiles, Soil horizons, Soil management, Soil physical properties, Soil surfaces, Geologic mapping, Mapping, Graphical methods, Mathematical studies, Baseline studies, Environmental effects, Evapotranspiration, Erosion, Consumptive use, Precipitation, Chinook, Computer programs.

A generalized soil map of the State of Montana and associated descriptive text were prepared. The completed color map has a scale of 1:1,000,000, and shows 132 mapping units named as associations of Great Groups of soils. Mapping units were grouped on the basis of soil order, physiography, and climatic regime. A computer-graphic system was successfully developed for retrieval/display of the soil map data, together with other compatible land resource information. Platter-drawn Montana maps show distributions of environmental variables, singularly or in combinations. These variables include: soils; first/last freeze dates; growing season length and precipitation,

## ENGINEERING WORKS—Field 8

### Hydraulic Machinery—Group 8C

annual precipitation; annual snowfall; climax vegetation; geology; potential evapotranspiration; consumptive water use; erosive rains; peak precipitation; strong chinook wind frequency; elevation; summer rainfall probabilities; and land area from LANDSAT remote-sensing imagery. Each map contains 18,060 cells; one cell represents 13.2 sq km. The computer/plotter system is used to delineate areas that are agriculturally/environmentally similar. Plotter-drawn composite maps show statewide distribution of lands with specified characteristics, thereby offering site selection capabilities and the extrapolation of research results. LANDSAT imagery and other published data are readily compatible with this map base. (Zielinski-MAXIMA)  
W83-00237

#### REMOTE SENSING OF WATER RESOURCES ON PACIFIC ISLANDS,

Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.

D. N. Contractor.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108019, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, June, 1982, 15 p, 4 Fig, 5 Tab, 4 Ref., OWRT A-023-GUAM (2), 14-34-0001-1112.

Descriptors: \*Remote sensing, \*Pacific islands, \*Aerial photography, \*Water resources development, Surface water, Tropical regions, Micronesia, \*Palau, \*Landsat data, Infrared imagery, Satellite technology, Sensors, Telemetry, Land classification, Water supply development.

The value of the Landsat data base for locating additional fresh water resources on remote Pacific islands was assessed, with specific attention given to a classification of land and water resources for Palau. Analysis of the 1975 Landsat image of Palau provided a land-cover classification of Babelthuap, Koror and the neighboring islands, Peleliu, and Anguar. The prominent land-cover features were identified and their areas obtained. Areas having potential value as additional fresh water sources were identified. The larger water resources included the water supply reservoir, the major rivers feeding into Karamado Bay, the Anguar phosphate mines, and the marine lakes in the rock islands. In an attempt to identify small scale features (e.g., groundwater seeps, taro patches), the spectral signature of the fresh water reservoir was used to identify other areas of similar characteristics. The areas brought out by this analysis were: coastline points where groundwater may leave the aquifer; ocean points suggesting submarine fresh water spring locations; and isolated inland fresh water locations. If there are several Landsat picture elements (area coverage: 1.1 acres), the probability of fresh water occurrence may be high; if only one element occurs, the probability will be low. Barring certain factors (cloud cover, resolution), Landsat data obtained over Pacific islands was deemed very useful for locating additional water resources. (Zielinski-MAXIMA)  
W83-00262

## 8. ENGINEERING WORKS

### 8A. Structures

#### THE STATISTICS OF EXTREME VALUES AND THE ANALYSES OF FLOODS IN SOUTH AFRICA,

Department of Water Affairs, Pretoria (South Africa), Div. of Hydrology.

For primary bibliographic entry see Field 2E.

W83-00089

#### PLUMBLINE MONITOR INTERFACE,

Bureau of Reclamation, Denver, CO. Engineering and Research Center.

For primary bibliographic entry see Field 8G.

W83-00094

#### KIELDER - PLANNING TO MEET THE FUTURE.

Water Services, Vol 86, No 1035, p 213, 214, 216, May, 1982, 4 Fig.

Descriptors: \*Reservoir design, \*Reservoir construction, \*Dam design, \*Earth dams, Construction, Weirs, Rivers, Tunnels, Water distribution, Water resources development, Water supply development, Reservoirs, Artificial lakes, \*United Kingdom, Kielder reservoir, \*Kielder dam.

Construction of a major reservoir at Kielder combined with a network of pipes and tunnels connecting the Tyne, Wear, and Tees was designed to provide water for the industrial Teesside area. The dam is the largest ever constructed in Britain, with the largest pumping station and largest manmade lake. The earth dam is 1.2 km long and 52 m high. It has a 180 m overflow weir and more than 700 recording instruments are buried in the dam to relay information on the state of the structure. The central clay core makes the dam water tight. A hydroelectric generating plant is planned for the main dam. The water transfer system was designed to provide 85% of the North-East region with abundant water to meet population and industrial needs. (Small-FRC)  
W83-00207

#### APPLICATION TO THE DES MOINES RIVER OF MULTIPLE RESERVOIR OPERATING STRATEGIES INCORPORATING SHORT-AND LONG-TERM INFORMATION IN REAL TIME,

Iowa Univ., Iowa City. Inst. of Hydraulic Research.

For primary bibliographic entry see Field 4A.  
W83-00248

#### HIGH PLAINS - OGALLALA AQUIFER STUDY WATER TRANSFER ELEMENT,

Corps of Engineers, Dallas, TX. Southwestern Div.

For primary bibliographic entry see Field 4A.  
W83-00312

#### DRAINAGE AND STRUCTURES.

Public Works, Manual, p B17-B27, 1982.

Descriptors: \*Storm sewers, \*Drainage engineering, \*Drainage systems, \*Culverts, \*Bridges, Drainage, Surface drainage, Conduits, Bridge design, Highways, Pipes, Flood control, Bridge Erosion control, Water control.

Drainage and subdrainage systems relevant to highway engineering are discussed as means of effectively avoiding flooding and damage to property. Types of pipe suitable for culverts and sub-drains, the design of culverts, and the installation and cleaning of culverts are described. Bridges are discussed including galvanized, panel, concrete, bridge protection, bridge cleaning, and inspection vehicles. Paved watercourses, tunnels, and types of piles are also discussed. Surface drainage control can prevent erosion, while proper culvert design can prevent silting and lower the water table when necessary. Product sources are listed for most structures discussed and include bridge flooring, expansion joints, concrete deck protection, bridge bearing pads, bridge railings, bridge forms, cleaning and painting equipment, and mobile scaffolds. (Small-FRC)  
W83-00334

#### SYSTEM MAINTENANCE.

Public Works, Manual, p C68-C74, 1982.

Descriptors: \*Maintenance, \*Conveyance structures, \*Water mains, \*Leakage, \*Cleaning, Flushing, Cracks, Pipes, Water-carrying capacity, Linings, Water loss, Coatings, Algal control, Weed control, Wells, Reservoirs.

Equipment necessary for water system maintenance is discussed for checking system condition as well as cleaning and making repairs. Detection devices are available for locating mains and valves, and equipment is described for measuring leakage.

measuring hydrant discharge, leak locators, and for the repairs of cracks and breaks in pipes. Main capacities are maintained through flushing, hydraulic pressure cleaning, mechanical cleaning, refining existing mains, and determining main hydraulics. Equipment available to assist in installing connections includes tapping machines, service clamps, and aids to the insertion of branches and valves. Maintenance departments also use products for repairing leaks in concrete as well as paints and coatings. Chemicals are generally used for killing algae and weeds in wells and reservoirs, and equipment can be used to dredge reservoirs or restore wells. Sources are given for most of the equipment discussed. (Small-FRC)  
W83-00339

### 8B. Hydraulics

#### LARGE-SCALE BEDFORMS IN THE PLATTE RIVER DOWNSTREAM FROM GRAND ISLAND, NEBRASKA: STRUCTURE PROCESS, AND RELATIONSHIP TO CHANNEL NARROWING,

Geological Survey, Denver, CO. Water Resources Div.

For primary bibliographic entry see Field 4D.  
W83-00111

#### THE FLOW OF SLURRY FROM A BREACHED TAILINGS DAM,

University of the Witwatersrand, Johannesburg (South Africa). Dept. of Construction Materials.

G. E. Blight, M. J. Robinson, and J. A. C. Diering. Journal of the South African Institute of Mining and Metallurgy (Johannesburg), Vol 81, No 1, p 1-8, January, 1981, 8 Fig, 7 Ref.

Descriptors: \*Mine wastes, \*Flow characteristics, \*Mathematical models, \*Dam failure, \*Hydraulic properties, Spoil banks, Strip mine wastes, Slurries, Slime, Hydraulics, Hydrodynamics, Flow discharge, Model studies, Prediction, Forecasting, Dams, Particle size, Physical properties, Viscous flow, Viscosity.

The wall of a tailings dam at Bafokeng failed, with about 3 million cu m of liquified tailings slurry flowing through the wall breach, engulfing a vertical mine shaft, and flowing on down the Kwa-Leragane River valley. The mechanism of the flow of the tailings slurry was examined, and a mathematical model was developed to describe the flow. Predictions based on the model were compared with the flow that actually occurred near the mine shaft following the tailings dam failure. The predictions were found to be of acceptable accuracy. Hence, the proposed analysis for the flow of a slurry appears to provide a realistic model of the process in that it predicts realistic depths of flow. The analysis was developed to enable the safety of surface installations in the vicinity of tailing dams to be examined. For this purpose, the static or stagnant depth of the slurry adjacent to an obstruction is required. The static depth is obtained by the addition of the velocity head to the dynamic flow depth (DFD). In the case considered, the velocity head has a value of about 5 m, which, when added to the DFD, compares favorably with the observed height to which the cladding of the winder house was damaged. Notwithstanding certain assumed uncertainties, it is considered that the analysis described provides a useful additional tool for the tailings disposal engineer. While useful, it would be difficult to predict slurry flow after River entry since the continuity equation would be complicated by the unknown increase in flow volume. (Zielinski-MAXIMA)  
W83-00285

### 8C. Hydraulic Machinery

#### LARGE WATER TRANSPORT PUMPS,

C. H. Laux.

Aqua, No 3, p 11-16, 1982, 11 Fig, 9 Ref.

Descriptors: \*Pumps, \*Water transport, Hydraulic machinery, Design criteria, Pumping, Economic aspects.

## Field 8—ENGINEERING WORKS

### Group 8C—Hydraulic Machinery

Water transport pumps, designed for heavy duty applications such as moving large volumes of water to high altitudes or over long distances, are designed to be compact and easily maintained. Guidelines for selection of water transport pumps are given, knowing the water analysis (clean or corrosive), the available net positive suction head (normally 11-18 m), and driver type. The lower the speed, the larger will be the pump. When low speeds are necessary because of corrosive water or other factors, a booster pump can be less costly than a single large low speed pump. The optimum number of pumps is determined by available space, the need for 1 standby pump for every 3 operating pumps, runout, and power input. Suggestions are given to improve pump life (distributing the head over multiple stages), reducing water hammer (large fly wheels), and minimizing maintenance (horizontally split casings). A formula determines the maximum running speed and specific speed. Usually a single stage pump is cheaper than a 2 stage pump, but it is often heavier, less efficient, and not suitable for sand-carrying or corrosive water. Driver types depend on the availability and strength of the electricity, the size and speed of the driver, and whether or not speed regulation is required. Electricity is commonly used where possible, but steam turbines are good for very large power inputs. Gas turbines, with fast startup and speed regulation, are often used in oil-producing countries. Possible adjustments to compensate for demand fluctuations are a combination of parallel operation of identical pumps driven by two speed motors, variable-speed pumps, combination of a variable-speed booster pump with a constant-speed main pump, combination of parallel and series operation of identical pumps, and combination of constant rate pump with storage reservoirs. (Cassar-FRC)

W83-00206

#### ASSESSMENT OF LOW HEAD, MICRO HYDROELECTRIC EQUIPMENT FOR USE ON SMALL TROPICAL ISLANDS,

Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific. D. N. Contractor, and S. J. Winter. Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108076, Price codes: A02 in paper copy, A01 in microfiche. Technical Report No 33, April, 1982. 8 p, 1 Tab. 3 Ref. OWRT A-024-GUAM(1), 14-34-0001-1112.

Descriptors: \*Hydroelectric plants, \*Tropical regions, \*Estimated costs, \*Design criteria, \*Feasibility studies, Evaluation, Power plants, Tropical islands, Developing countries, Economic aspects, Cost-benefit analysis, Cost repayment, Electrical equipment, Power head, Flow duration, \*Ponape Island.

An investigation was made of two potential sites on an underdeveloped tropical island (Ponape island) for installing a micro-hydroelectric generation unit. The technology for this development already exists and has been proven to be cost-effective in developed countries. Preliminary investigations were made to size candidate units, manufacturers of hydro equipment suitable for installation at these sites were identified, and price quotations were obtained. Daily discharge data for four rivers were used to obtain flow-duration curves. The curves indicated that the hydrologic regimes of the rivers were similar. Hence, the mean line through the curves could be used as a prediction for other watersheds in the same general area. Estimated flow and power-duration curves were developed for each of the two sites. Recommendations for equipment requirements were derived for each site from the power-duration curves. Further study is needed prior to ordering either of the two candidate units identified, including cost estimates for shipping, installation, and for the electric transmission and distribution lines. It was concluded, however, that the findings of this preliminary study show that a micro-hydroelectric generation system installed at either or both of the sites would satisfy electrical needs of a small tropical island in a cost-effective manner. (Zielinski-MAXIMA)

W83-00268

#### MAINS AND SERVICES.

Public Works, Manual, p C26-C35, 1982.

Descriptors: \*Water distribution, \*Pipelines, \*Conveyance structures, \*Water mains, \*Pipes, Concrete pipes, Metal pipes, Plastic pipes, Plumbing, Construction joints, Mechanical equipment, Coatings.

Underground pipelines for water distribution and service lines are described. Materials for mains include ductile iron, plastic or thermoplastic, steel, asbestos-cement, and cement. Information is presented on joints, fittings, and coatings. Services are of steel, iron, copper, brass, or plastic. Corporation and curb stops attach to the water mains, and are discussed in terms of service boxes, tunneling and pushing, pipe handling, and pipe cutting. Sources for the equipment discussed are listed to aid the engineer in gathering information about what is a major part of any water system investment. (Small-FRC)

W83-00313

#### COLLECTION SYSTEMS.

Public Works, Manual, p D2-D10, 1982.

Descriptors: \*Sewer systems, \*Conveyance structures, \*Water mains, \*Construction, Concrete pipes, Plastic pipes, Steel pipes, Construction joints, Construction materials, Wastewater facilities, Pipes, Plumbing.

Collection systems, the largest investment in a sewerage system, are discussed, including the piping system, sub-mains, mains, interceptors, and manholes. Specifications for vitrified clay pipe; pipe fittings and specials; pipe manufacturers; and methods of testing, installing, and joining clay pipe are discussed. Gravity flow concrete sewer pipe is discussed, including manufacturers, ASTM specifications, lining materials, coatings, pipe manufacture, build-in-place sewers, joints, and tapping sewers. PVC, ABS, and PE thermoplastic sewer pipes, asbestos-cement pipe, ductile iron pipe, and corrugated pipe are also considered. Equipment related to sewers includes manholes, pipe tools, regulators, and small pressurized and vacuum systems. Suppliers are listed for most of the equipment discussed. (Small-FRC)

W83-00038

#### WATER STORAGE.

Public Works, Manual, p C48-C56, 1982.

Descriptors: \*Water storage, \*Standpipes, \*Storage tanks, \*Reservoirs, \*Water distribution, Construction materials, Design criteria, Coatings, Prestressed concrete, Water tanks, Storage, Reinforced concrete, Wells, Reservoir linings, Reservoir storage, Reservoir evaporation, Mechanical equipment.

Distribution system storage to supply peak loads and to provide a reserve for fire fighting is discussed, and elevated and ground storage systems are described. Elevated tanks and standpipes include circular steel tanks, tubular columns, double ellipsoidal tanks, and hemispherical bottom tanks. Elements of tank design include tank bottoms, towers, risers, and multiple-use tanks. Coating systems are important especially for the protection of steel tanks, and cathodic protection can be used to prevent rust, erosion, and pitting. Reinforced concrete tanks and prestressed tanks are used. Equipment for developing groundwater sources includes vertical wells, gravel-well wells, well screens, horizontal wells, and sand removers. Aspects of surface reservoirs include natural liners, rigid liners, flexible membrane liners, reservoir evaporation retardants and covers, and collapsible tanks. Sources are listed for all of the equipment discussed. (Small-FRC)

W83-00340

## 8G. Materials

#### PLASTICS GIVE 20 YEARS LIFE-SPAN - WITH VIRTUALLY ZERO MAINTENANCE.

Water and Waste Treatment, Vol 25, No 5, p 28-29, May, 1982.

Descriptors: \*Plastics, \*Materials engineering, Polymers, Storage tanks, Water tanks, Holding tanks, Settling tanks, Construction materials, Clarifiers, Wastewater treatment, Water treatment facilities.

Polypropylene and composites of Polypropylene/GRP and UPVC/GRP have withstood the tests of time and are most useful as building materials for tanks utilized in the water and wastewater treatment industries. The all polypropylene tank is one of the lowest cost tanks based on price per gallon. Tanks up to 50,000 gallons are reinforced with an external polyester resin glass fiber laminate. These types of tanks can be engineered to British Standard 4494:1973. When purchasing a plastic vessel, it is important to make certain the supplier can construct vessels in a variety of materials. Some companies offering full design facilities offer long term serviceability on polypropylene and GRP reinforced polypropylene tanks. Most vessels have a design life of 12-20 years. Thermoplastic GRP reinforced vessels usually offer a built-in test facility. In the water and wastewater treatment industries, these plastics are used to store reagents and very pure water for critical applications. Tanks of these plastics prove very economical and can be fitted with integral agitator bridges. Polypropylene is being used in settling tanks, clarifiers, mixing tanks, gas scrubbers, salt saturation units, and vessel intervals. (Geiger-FRC)

W83-00008

#### PLUMBLINE MONITOR INTERFACE,

Bureau of Reclamation, Denver, CO. Engineering and Research Center. E. Campbell.

Report GR-81-15, December 1981, 10 p, 3 Fig.

Descriptors: \*Dam safety, \*Monitoring, \*Plumb lines, Safety, Dam stability, Sensors, Computers.

Various devices have been developed to determine movement of dams as a part of the Safety of Dams Program. One such device is a plumbline to be hung near the top of a vertical shaft within a dam. At the bottom of the shaft the movement of the plumbline can be measured, but reading by maintenance personnel on an intermittent basis does not render accurate or consistent data. A continuous reading, computer compatible, plumbline monitoring device is being developed. The plumbline position is sensed by a Kaman Model KD 2612 non-contacting, two-channel measuring system. The position data is transformed into two bipolar dc voltage outputs. An electronic interface was developed to convert the bipolar variable dc signal level to appropriate TTL (transistor-transistor logic) drive pulses for actuating a two axis stepper motor drive system - for an X-Y translation table. Although the interface was designed for this specific purpose, the principle of operation would be useful in any system requiring signal conversion of this type. (Moore-SRC)

W83-00094

#### CATHODIC PROTECTION OF WATER MAINS,

East Bay Municipal Utility District, Oakland, CA. A. E. Westerback.

Public Works, Vol 113, No 4, p 49-53, April, 1982. 6 Fig, 2 Tab, 4 Ref.

Descriptors: \*Water mains, \*Corrosion control, Pipes, Steel, Maintenance, Pipelines, Conveyance structures.

Cathodic protection, which involves replacing electrons to a metal structure at a rate higher than they are lost, is the most effective means available to control exterior corrosion of metallic pipelines. There are two methods for achieving cathodic protection. Sacrificial anode or galvanic anode cathodic protection is a process in which the steel part to be protected is connected to a suitably sized piece of metal more active than steel. The more active metal corrodes at an accelerated rate, protecting the steel. The second method, impressed

## ENGINEERING WORKS—Field 8

### Fisheries Engineering—Group 81

current cathodic protection, involves rectifying alternating current to direct current and impressing this current from a buried anode to the pipe. This method is practical for treatment of large diameter, poorly coated pipelines where the current demand is too high to be supplied by galvanic anodes. The East Bay Municipal Utility District in Oakland, California, has successfully used impressed current cathodic protection for its pipelines since the early 1930's. The use of sacrificial anode cathodic protection of pipelines by the District since 1969 also appears to be very successful in controlling corrosion. A cost-benefit study indicated an overall benefit to cost ratio of about 6 to 1. While sacrificial anode cathodic protection is relatively harmless to foreign pipelines and can be only beneficial to a pipeline, impressed current cathodic protection can cause corrosion damage to metallic pipes if it is not used properly. Impressed current corrosion protection should be installed only under the direction of a corrosion control engineering expert, as it can lead to corrosion damage to metallic pipe which may be located between the anode bed of the pipeline. (Carroll-FRC)  
W83-00175

**INTENSIVE FLOW MONITORING—COST-EFFECTIVENESS WITH A QUALITY EDGE,**  
Thomas (Frank A.) and Associates, Inc., Wil-  
loughby, OH.  
For primary bibliographic entry see Field 5G.  
W83-00200

**A NEW METHOD OF LEAK DETECTION IN  
DISTRIBUTION SYSTEMS UNDER PRES-  
SURE: ACOUSTIC CORRELATION,**  
Compagnie Generale des Eaux, Paris (France).  
P. Arnac.  
Aqua, No. 3, p 410-417, 1982. 13 Fig, 1 Tab, 14 Ref.

Descriptors: \*Leakage, \*Acoustics, \*Measuring instruments, Water distribution, Noise, Water conveyance, Water loss.

The acoustic correlation method has been used in France to detect leaks in water distribution systems since 1978. The conventional acoustic method works well under most circumstances, but leaks in noisy environment and leak deeper than 2 meters may be very difficult to locate. In addition, leak noises may be transferred some distance from their actual location. The acoustic correlation method uses 3 leak noise characteristics (production, propagation, and permanence in time). The theoretical equations of the underlying principles of acoustic correlation are given. Equipment consists of the mobile equipment (2 each of sensors, amplifiers, links between sensors and processing unit) and the equipment inside a vehicle (signal filters, amplifiers, correlator, visualizing equipment, and post computer). The correlator is the heart of the apparatus. Depending on the correlator, a reach up to 260 m can be inspected with accuracy. Generally the distance between sensors is 100-200 m. The correlation method is superior to the conventional method in many cases, but the two methods can be used together to cover most situations. (Cassar-FRC)  
W83-00205

**METERING, MONITORING AND QUALITY  
CONTROL,**  
Public Works, Manual, p C56-C68, 1982.

Descriptors: \*Water metering, \*User charges, \*Water measurement, \*Laboratory equipment, \*Monitoring, \*Process control, Water sampling, Current meters, Water costs, Gages, Remote control, Remote sensing, Colorimetry, Photometry, Hydrogen ion concentration, Turbidity, Conductivity.

Metering is discussed as the basis for determining equitable customer charges, and monitoring and quality control are considered as aspects of controlling the treatment process. Displacement meters, multi-jet meters, current meters, and compound meters are available as well as aids to meter testing and repair, updating old meters, and remote meter reading. Mainline meters are primarily flow

meters, and various indicator-recorders are available. Remote control involves telemetering systems including electric, electronic, and pneumatic. Sensors for automatic systems and transmission and reception equipment are used. Laboratory equipment includes visual colorimetric tests, photometric instruments, pH meters, turbidity measurers, and conductivity instruments. Instruments are also needed for microbiological analysis. Instruments for process control include various monitors including turbidity monitors and automatic samplers. Sources are given for most of the equipment discussed. (Small-FRC)  
W83-00336

### 81. Fisheries Engineering

#### EVALUATION OF LIMNOLOGICAL PARAMETERS AS RELATED TO THE SUCCESS OF MYSIS RELENTA INTRODUCTIONS,

Wyoming Univ., Laramie. Water Resources, Research Inst.

J. J. Grabowski, and J. Ahern.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108589, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Series No 85, May, 1982. 164 p, 21 Fig, 10 Tab, 110 Ref, 3 Append. OWRT A-031-WYO(1), 14-34-0001-1154.

Descriptors: \*Limnology, \*Lake restoration, \*Shrimp, \*Fish populations, \*Feasibility studies, Lake morphology, Prediction, Lake morphometry, Lake stages, Lake fisheries, Lakes, Trout, Fish management, Fisheries, Lake fisheries, Water quality, Water quality control.

A predictive tool was developed to aid fishery managers in determining whether opossum shrimp (*Mysis relicta*) should be introduced in montane lakes to increase lake trout production. A comparative was undertaken during 1981 to determine the impact of introducing the shrimp to three subalpine Wyoming lakes on the lake ecosystems. Biological, chemical, and physical parameters were monitored during the course of study. Further, the general life history characteristics of the introduced shrimp populations were analyzed relative to the limnological data. The introduced shrimp populations were found to be strongly influenced by ambient water quality and lake productivity. The predictive cold-water fisheries management tool was derived from the study results and pertinent literature information. This tool consists of nine parameters: lake trophic status, plankton abundance/composition, resident fish species, lake bathymetry, water temperatures, metalimnion thermal gradient, dissolved oxygen level, acidity levels, and dissolved ion content. These parameters should be considered or measured in relation to one another by the fisheries manager before shrimp introduction. (Zielinski-MAXIMA)  
W83-00255

#### SOME VARIATIONS IN DISTRIBUTION OF FISHES IN LARGE MAINSTREAM RESERVOIRS ASSOCIATED WITH ARTIFICIAL COVER,

Kentucky Water Resources Research Inst., Lexington.

D. W. Johnson, and E. M. Choinski.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108597, Price codes: A04 in paper copy, A01 in microfiche. Research Report No 135, July, 1982. 56 p, 17 Fig, 6 Tab, 47 Ref, 1 Append. OWRT A-080-KY(1), 14-34-0001-0119/1119.

Descriptors: \*Fish populations, \*Reservoirs, \*Fish attractants, \*Fish behavior, \*Fish migration, Fish control agents, Fish management, Submerged plants, Aquatic populations, Aquatic environment, Fish establishment, Fish harvest, Fish farming, \*Artificial cover, Sport fishing.

The influence of submerged artificial cover afforded by brush piles on fish populations in two lakes (Kentucky Lake and Lake Barkley) was investigated. Both mature and larval fish were sampled from deep and shallow lake sites, with/without artificial

cover. Highest densities of mature crappie, black bass, and sauger fish critical to the Tennessee Valley recreation industry, were found adjacent to deeply placed (greater than 4 meters) attractors. Larval crappie and minnows were most concentrated at shallow brush piles. Installation of natural materials (brush attractors) was more effective in aggregating sport fish than industrial products (tires). Adult/larvae shad did not congregate at attractor sites. Tagging studies indicated that most bass and crappie do not move far from winter to spring spawning substrate and summer cover. The results obtained in this investigation support the continuation of artificial cover installation and water level management procedures which will provide high and stable fish populations through spring spawning and early development. Installation of suitable cover in reservoir littoral zones and use of high and stable water levels flooding natural vegetation enhance reproductive success and survival of sport fish populations. (Zielinski-MAXIMA)  
W83-00255

#### INSTREAM SALMONID HABITAT EXCLUSION BY ICE-COVER,

Wyoming Univ., Laramie. Water Resources Research Inst.

L. S. Johnson, D. L. Wickers, T. A. Wesche, and J. A. Gore.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108613, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Series No 84, May, 1982. 29 p, 4 Fig, 4 Tab, 19 Ref. OWRT B-038-WYO, 14-34-0001-8130.

Descriptors: \*Aquatic habitats, \*Ice cover, \*Prediction, \*Mathematical equations, \*Fish populations, Fish, Habitats, Trout, Environment, Instream flow, Salmon, Linear programming, Regression analysis, Mathematical studies, Stream fisheries, Management planning, \*Wyoming, Wagonhound Creek.

Research was conducted on a small Wyoming foothills stream (Wagonhound Creek) in an attempt to develop a method for predicting the effect of winter ice-cover on the habitat available to a brown trout population. Predictive equations were developed relating the percent of the habitat excluded to days from the winter solstice, degree days of frost, mean water velocity, and mean effective water depth, inclusively. The equations represented the degree of habitat excluded from each of three areas (riffle, run, and pool) at the measurement site, and were solved using multiple linear regression analyses of ice cover. The resultant predictions accurately reflected the conditions on the study stream. While winter instream flow requirements are nebulous, stream managers can make habitat available on regulated streams by estimating what areas are the most critical and how much of the habitat needs to be made available. Knowledge of habitat preferenda at other seasons and the relative stream size would aid subjective judgements concerning the amount of habitat needed. The reported method could be of value to resource managers in determining winter instream flows to maintain trout habitat. (Zielinski-MAXIMA)  
W83-00257

**PRODUCTION OF REPRODUCTIVELY LIM-  
ITED GRASS CARP FOR BIOLOGICAL CON-  
TROL OF AQUATIC WEEDS - PHASE II,**  
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.

For primary bibliographic entry see Field 4A.  
W83-00272

## Field 10—SCIENTIFIC AND TECHNICAL INFORMATION

### Group 8I—Fisheries Engineering

#### 10. SCIENTIFIC AND TECHNICAL INFORMATION

##### 10D. Specialized Information Center Services

**EFFECTIVE GRAPHICAL DISPLAY OF WATER RESOURCE PLANNING INFORMATION FOR DECISION MAKERS, VOLUME I,** Gates (W. E.) and Associates, Inc., Batavia, OH. R. M. Males.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-109827, Price codes: A06 in paper copy, A01 in microfiche. Final Report, May, 1982. 101 p, 29 Fig, 3 Tab. 17 Ref. OWRT C-90131-C(9461)(1), 14-34-0001-9461.

Descriptors: \*Graphical methods, \*Water resources development, \*Management planning, \*Decision making, \*Information exchange, Graphical analysis, Mathematical studies, Water supply development, Water management, Administrative decision making, Information systems, Technology transfer, Communication.

The use of graphic communication techniques was investigated as a potential mechanism for responding to the problems of information transfer in water resources planning. It was expected that well-developed technologies for graphic display, clear information transfer points, and types of data could be found in order to test the application of the graphic techniques to the data types. This was not the case. It was determined that understanding is not only central to improved decision-making, but it is also central to the development of graphical display techniques themselves. The need for communications, understanding, the current nature of the planning process, and the nature of decision makers, relative to graphics use, were all explored. It is requisite that technologists become sensitized to better observe graphic communications. As a follow-on to this, and with the identified problems in mind, the basic graphic techniques and problems are presented (e.g., basic chart types, 3-dimensional treatments, maps, multi-variate techniques), followed by a portfolio of techniques relative to charts. Following the development of this general pictorial display, a water resources portfolio is developed and elaborated, demonstrating various graphical examples (e.g., frontal storm patterns, alkalinity quadograms, stream discharge maps, environmental impact matrix). (Zielinski-MAXIMA) W83-00273

**EFFECTIVE GRAPHICAL DISPLAY OF WATER RESOURCES PLANNING INFORMATION FOR DECISION MAKERS, VOLUME II,** Gates (W. E.) and Associates, Inc., Batavia, OH. R. M. Males.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-109835, Price codes: A05 in paper copy, A01 in microfiche. Final Report, May, 1982. 83 p, 11 Fig, 18 Ref, 4 Append. OWRT C-90131-C(9461)(2), 14-34-0001-9461.

Descriptors: \*Graphical methods, \*Water resources development, \*Management planning, \*Decision making, \*Information exchange, Graphical analysis, Mathematical studies, Water supply development, Water management, Administrative decisions, Information systems, Technology transfer, Communication.

The use of graphic communication techniques was investigated as a potential mechanism for responding to the problems of information transfer in water resources planning. This second volume of this 2-volume report presents information concerning the conceptual and theoretical basis of the overall study. Guidelines and techniques were developed for enhancing graphic literacy, representing a means for enhancement in knowledge and understanding of the uses and methods of communication. The guidelines and techniques are presented in the format of 'frames' (single pages that use a combination of charts, maps, and text) to explore and demonstrate concepts related to the

proper use of graphics. The techniques and guidelines were developed through investigation of the uses and techniques of graphic information in other disciplines, and a review of example graphic presentation in the water resources field. The frames are designed to be used as training and educational aids to enhance graphic literacy. Material relating to conceptual and theoretical issues of information transfer and decision making in water resources planning is also included. The basic information assembled on graphic techniques and graphic literacy is presented in the first volume of this 2-volume report. The topic of data display by graphic methods as a potential solution to the information transfer problem is frequently suggested. (Zielinski-MAXIMA) W83-00274

**HAZARDOUS WASTE TECHNOLOGY TRANSFER ASSESSMENT,** Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 5E. W83-00276

#### 10F. Preparation Of Reviews

**GUIDELINES FOR SURFACE WATER QUALITY: VOL 1: INORGANIC CHEMICAL SUBSTANCES: COPPER,** Department of the Environment, Ottawa (Ontario). Inland Waters Directorate. For primary bibliographic entry see Field 5G. W83-00079

**WATER RECLAMATION AND REUSE,** Alberta Univ., Edmonton. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W83-00163

**PULP AND PAPER EFFLUENT MANAGEMENT,** Tufts Univ., Medford, MA.; and National Council for Air and Stream Improvement, Inc., Medford, MA. For primary bibliographic entry see Field 5D. W83-00164

**LAW,** Virginia Water Resources Center, Blacksburg. For primary bibliographic entry see Field 6E. W83-00165

**WATER CHARACTERISTICS,** Construction Engineering Research Lab. (Army), Champaign, IL. For primary bibliographic entry see Field 5B. W83-00169

**HO: FOR REESE RIVER NATURAL RESOURCES OF THE TOIYABE-TOQUIMA HIGHLANDS, CENTRAL NEVADA,** Nevada Univ. System, Reno. Desert Research Inst. For primary bibliographic entry see Field 6B. W83-00253

**ACIDIC PRECIPITATION AND ITS CONSEQUENCES FOR AQUATIC ECOSYSTEMS: A REVIEW,** Columbia National Fishery Research Lab., MD. For primary bibliographic entry see Field 5C. W83-00331

## **SUBJECT INDEX**

|   |  |           |   |           |  |
|---|--|-----------|---|-----------|--|
| <b>2</b>  | <b>The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System, W83-00332</b> | <b>5B</b> | <b>Cause of Inefficient Solids Separation in the Activated Sludge Process, W83-00232</b>  | <b>5D</b> | <b>AGRICULTURAL HYDROLOGY</b>  |
|   |  |           | <b>Secondary Treatment, W83-00325</b>   | <b>5D</b> | <b>Efficient Use of Water for Irrigation in the Upper Midwest, W83-00242</b> |
| <b>208 PROGRAM</b>  |  |           | <b>The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge, W83-00327</b>  | <b>5D</b> | <b>3F</b>  |
| <b>Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240</b>   | <b>6B</b>  |           |   |           |  |
| <b>ABSORPTION</b>   |  |           |   |           |  |
| <b>Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton, W83-00344</b>   | <b>2H</b>  |           | <b>ADDITIONS</b>  |           |  |
|   |  |           | <b>Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222</b>  | <b>3A</b> |  |
| <b>ACID MINE DRAINAGE</b>   |  |           |   |           |  |
| <b>The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation, W83-00258</b>  | <b>5G</b>  |           | <b>ADENOSINE TRIPHOSPHATE</b>   |           |  |
|   |  |           | <b>Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes, W83-00149</b>  | <b>5D</b> |  |
| <b>Sludge Disposal from Acid Mine Drainage Treatment, W83-00298</b>   | <b>5E</b>  |           |   |           |  |
|   |  |           | <b>ADIRONDACKS</b>  |           |  |
| <b>Stratigraphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery, W83-00329</b>  | <b>2H</b>  |           | <b>An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation, W83-00245</b>   | <b>5G</b> |  |
| <b>ACID RAIN</b>  |  |           |   |           |  |
| <b>An Overview of Acid Rain Monitoring Activities in North America, W83-00189</b>   | <b>5C</b>  |           | <b>ADMINISTRATION</b>   |           |  |
|   |  |           | <b>Control Operations and Maintenance Services, W83-00157</b>   | <b>5D</b> |  |
| <b>Lake Restoration Technology Transfer Assessment, W83-00215</b>   | <b>5G</b>  |           |   |           |  |
|   |  |           | <b>ADSORPTION</b>   |           |  |
| <b>Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review, W83-00331</b>  | <b>5C</b>  |           | <b>Absorption of PAH to Aquatic Humus, W83-00038</b>  | <b>5B</b> |  |
| <b>ACIDIC WATER</b>   |  |           |   |           |  |
| <b>Induction of High Phosphatase Activity by Aluminum in Acid Lakes, W83-00029</b>  | <b>5B</b>  |           | <b>Association Studies of Polybrominated Biphenyls in Aquatic Systems, W83-00160</b>  | <b>5B</b> |  |
|   |  |           |   |           |  |
| <b>Characterization of Acid Phosphatases in the Acidified Lake Gardsjön, Sweden, W83-00050</b>  | <b>5C</b>  |           | <b>ADVANCED WASTEWATER TREATMENT</b>  |           |  |
|   |  |           | <b>High-Quality Trickling Filter Effluent Without Tertiary Treatment, W83-00142</b>   | <b>5D</b> |  |
| <b>An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation, W83-00245</b>   | <b>5G</b>  |           |   |           |  |
| <b>ACOUSTICS</b>  |  |           | <b>Advanced Treatment, W83-00151</b>  | <b>5D</b> |  |
| <b>A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation, W83-00205</b>   | <b>8G</b>  |           |   |           |  |
|   |  |           | <b>Advanced Biological Treatment to Achieve Nutrient Removal, W83-00349</b>   | <b>5D</b> |  |
| <b>ACTIVATED CARBON</b>   |  |           |   |           |  |
| <b>Absorption of Toxic and Carcinogenic Compounds from Water, W83-00171</b>   | <b>5F</b>  |           | <b>AERATED LAGOONS</b>  |           |  |
|   |  |           | <b>Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation, W83-00284</b>                         | <b>5D</b> |  |
| <b>New Technology for Drinking Water Treatment, W83-00198</b>   | <b>5F</b>  |           |   |           |  |
|   |  |           | <b>AERATION</b>   |           |  |
| <b>ACTIVATED SLUDGE PROCESS</b>   |  |           | <b>Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System, W83-00024</b>  | <b>5G</b> |  |
| <b>The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works, W83-00133</b> | <b>5D</b>  |           |   |           |  |
|   |  |           | <b>The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works, W83-00133</b> | <b>5D</b> |  |
| <b>Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes, W83-00149</b>  | <b>5D</b>  |           |   |           |  |
|   |  |           | <b>Water Quality Simulation of Wahiawa Reservoir, O'ahu, Hawaii, W83-00281</b>  | <b>5G</b> |  |
| <b>Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics, W83-00179</b>  | <b>5D</b>  |           |   |           |  |
|   |  |           | <b>Secondary Treatment, W83-00325</b>   | <b>5D</b> |  |
| <b>Effect of a Bacterial Culture Product on Biogeochemical Kinetics, W83-00212</b>  | <b>5D</b>  |           |   |           |  |
|   |  |           | <b>AERIAL PHOTOGRAPHY</b>   |           |  |
| <b>Remote Sensing of Water Resources on Pacific Islands, W83-00262</b>  | <b>7C</b>  |           | <b>Remote Sensing of Water Resources on Pacific Islands, W83-00002</b>  | <b>7C</b> |  |
|   |  |           |   |           |  |
| <b>AEROBIC CONDITIONS</b>   |  |           | <b>AEROBIC DEGRADATION OF DIURON BY AQUATIC MICROORGANISMS, W83-00002</b>   | <b>5B</b> |  |
| <b>Aerobic Degradation of Diuron by Aquatic Microorganisms, W83-00002</b>   | <b>5B</b>  |           |   |           |  |
|   |  |           | <b>AEROSOLS</b>   |           |  |
| <b>Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review, W83-00331</b>  | <b>5C</b>  |           | <b>Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review, W83-00284</b>  | <b>5C</b> |  |
|   |  |           |   |           |  |
| <b>Effect of a Fungal Parasite on a Tetraselmid (Prasinophyceae) Species, W83-00288</b>   | <b>5C</b>  |           |   |           |  |

## SUBJECT INDEX

### ALGORITHMS

#### ALGORITHMS

Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works, W83-00291

5D

#### ALIPHATIC HYDROCARBONS

Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters, W83-00219

5B

#### ALKALINITY

High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment, W83-00243

5D

#### ALTERNATIVE PLANNING

An Alternative to the Peripheral Canal, W83-00193

6G

#### ALUM

Rapid-Mix Design for Mechanisms of Alum Coagulation, W83-00170

5F

#### ALUMINUM

Induction of High Phosphatase Activity by Aluminum in Acid Lakes, W83-00029

5B

#### ALUMINUM SULFATE

Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques, W83-00006

5C

#### AMINO ACIDS

The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands), W83-00178

5C

#### AMMONIA

Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme, W83-00196

5A

#### AMMONIUM

Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer, W83-00040

2H

Nitrogen Metabolism in Lake Kizaki, Japan. I. Ammonium and Nitrate Uptake by Phytoplankton, W83-00344

2H

#### ANAEROBIC DIGESTION

Investigations on Cellulose Biodegradation in Activated Sludge Plants, W83-00013

5D

A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters, W83-00138

5D

Fixed-Film Biological Processes, W83-00191

5D

Digester Control Pays Dividends, W83-00192

5D

#### APPLICATION RATES

Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential, W83-00233

5E

Water Saving Techniques, W83-00309

3F

#### AQUATIC BACTERIA

Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters, W83-00219

5B

#### AQUATIC FUNGI

Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters, W83-00219

5B

The Occurrence of a Fungal Parasite on a Tetradselma (Prasinophyceae) Species, W83-00288

5C

#### AQUATIC HABITATS

Instream Salmonid Habitat Exclusion by Ice-Cover, W83-00257

8I

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review, W83-00331

5C

#### AQUATIC MICROCOMS

Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms, W83-00214

5B

#### AQUATIC PLANTS

The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance, W83-00036

2H

Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers, W83-00051

5B

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake, W83-00053

5C

Algae Removal by Induced Air Flotation, W83-00277

5G

#### AQUATIC WEED CONTROL

Aquatic Weed Control with Endothall in a Salt River Project Canal, W83-00166

4A

Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II, W83-00272

4A

The Ecological Effects of 2-Methylthiotaiazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion, W83-00343

5C

#### AQUIFER CHARACTERISTICS

Geohydrology of Southwestern Kansas, W83-00059

7C

The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada, W83-00060

4B

Summary Appraisals of the Nation's Ground-Water Resources-New England Region, W83-00120

4B

Estimated Effects of Projected Ground-Water Withdrawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida, W83-00130

4B

A Preliminary Study of Natural Aquifer Discharge of Guam, W83-00271

5B

#### AQUIFER MANAGEMENT

The Ogallala-Half Full or Half Empty., W83-00017

6D

High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts, W83-00308

6B

#### AQUIFER SYSTEMS

High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts, W83-00308

6B

#### AQUIFERS

Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069

7C

Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas, W83-00075

7C

Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana, W83-00109

4B

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma, W83-00110

7C

Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981, W83-00115

7C

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-00116

7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York, W83-00117

7C

Designation of Principal Water-Supply Aquifers in Minnesota, W83-00125

2F

High Plains - Ogallala Aquifer Study Water Transfer Element, W83-00312

4A

#### AREAL PRECIPITATION

The Analyses of Areal Rainfall Using Multi-Quadratic Surfaces, W83-00088

2B

#### ARGENTINA

A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina, W83-00022

5C

#### ARID-ZONE HYDROLOGY

Social and Political Aspects of Drought, W83-00186

6B

#### ARIZONA

The USLE Rainfall Factor for Southwestern U. S. Rangelands, W83-00098

4D

Sediment Yield from Small Semiarid Rangeland Watersheds, W83-00105

4D

Application of Remote Sensing in Evaluating Flood-Water Farming on the Papago Indian Reservation, W83-00230

3F

Angora Goats for Conversion of Arizona Chaparral: Early Results, W83-00299

3B

Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral, W83-00300

5B

## SUBJECT INDEX

### BRUSH CONTROL

|  |    |  |    |  |    |
|--|----|--|----|--|----|
| Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona, W83-00301                  | 4D | The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands), W83-00178                                     | 5C | <b>BIODEGRADATION</b><br>Aerobic Degradation of Diuron by Aquatic Microorganisms, W83-00002  | 5B |
| Water Yield Changes Resulting from Treatment of Arizona Chaparral, W83-00303   | 3B | Effect of a Bacterial Culture Product on Biological Kinetics, W83-00212  | 5D | Investigations on Cellulose Biodegradation in Activated Sludge Plants, W83-00013   | 5D |
| <b>ARKANSAS</b>  |    | Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake, W83-00315   | 5G | <b>BIOLOGICAL CONTROL</b><br>Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II, W83-00272 | 4A |
| Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1980 Water Year, W83-00063 | 4A | Preliminary Studies on the Treatment of Cannery Factory Effluent with an Integrated Bacterial-Algal-Fish System, W83-00317   | 5D | <b>BIOLOGICAL FILTERS</b><br>Secondary Treatment, W83-00325  | 5D |
| <b>ARKANSAS RIVER BASIN</b>  |    | BACTERIAL ANALYSIS<br>High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment, W83-00243   | 5D | <b>BIOLOGICAL OXYGEN DEMAND</b><br>Bioassay Technique for Relative Toxicity in Water Pollution Control, W83-00146                          | 5A |
| Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1980 Water Year, W83-00063 | 4A | <b>BANK EROSION</b><br>Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa, W83-00218   | 4D | <b>BIOLOGICAL WASTEWATER TREATMENT</b><br>Fixed-Film Biological Processes, W83-00191   | 5D |
| <b>AROMATIC COMPOUNDS</b>  |    | BELGIUM<br>The Water Supply of the Brussels Urban Area and its Surroundings, W83-00020   | 5F | Advanced Biological Treatment to Achieve Nutrient Removal, W83-00349   | 5D |
| Adsorption of PAH to Aquatic Humus, W83-00038  | 5B | Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System, W83-00024  | 5G | <b>BIO MASS</b><br>Diel Periodicity in the Chemical Composition of Lake Phytoplankton, W83-00049   | 5B |
| <b>ARTIFICIAL COVER</b>  |    | Some Aspects of the Colonization by Water Mites (Acari, Actinedida) of an Artificial Substrate in a Disturbed Environment, W83-00054   | 5C | <b>BIOOXIDATION</b><br>Biooxidation of Paint Process Wastewater, W83-00143   | 5D |
| Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover, W83-00255                       | 8I | <b>BOB LAKE</b><br>Improvements in Quantifying the Phosphorus Concentration in Lake Water, W83-00208   | 5C |  |    |
| <b>ARTIFICIAL LAKES</b>  |    | <b>BOREHOLES</b><br>Groundwater is the Answer to Zambia's Water Problem, W83-00225   | 4B |  |    |
| Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage, W83-00023   | 5G | <b>BORON</b><br>Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique), W83-00047                                    | 5A |  |    |
| Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes, W83-00025  | 5C | <b>BRACKISH WATER</b><br>The Incidence of <i>Vibrio Cholerae</i> in Water, Animals and Birds in Kent, England, W83-00012   | 5B |  |    |
| <b>ARTIFICIAL PRECIPITATION</b>  |    | <b>BRAIDED STREAMS</b><br>Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing, W83-00111 | 4D |  |    |
| The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent, W83-00084   | 2B | <b>BRIDGES</b><br>Drainage and Structures, W83-00334   | 8A |  |    |
| <b>ATOMIC ABSORPTION SPECTROPHOTOMETRY</b>   |    | <b>BROMIDES</b><br>Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land, W83-00264   | 5B |  |    |
| Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique), W83-00047                | 5A | <b>BRUSH CONTROL</b><br>Angora Goats for Conversion of Arizona Chaparral: Early Results, W83-00299   | 3B |  |    |
| <b>AUSTRALIA</b>   |    | <b>BIOASSAY</b><br>Bioassay Technique for Relative Toxicity in Water Pollution Control, W83-00146  | 5A |  |    |
| Daily Chemical Variability of Domestic Septic Tank Effluent, W83-00328   | 5D | Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral, W83-00300   | 5B |  |    |
| <b>AUTOMATION</b>  |    | <b>BRUSH CONTROL</b><br>Angora Goats for Conversion of Arizona Chaparral: Early Results, W83-00299   | 3B |  |    |
| Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes, W83-00314                                      | 5F | <b>BUOYS</b><br>Aerobic Degradation of Diuron by Aquatic Microorganisms, W83-00002   | 5B |  |    |
| <b>BACTERIA</b>  |    | <b>CHEMICAL POLLUTION</b><br>Chemical Pollution in the Environment, W83-00021  | 5A |  |    |
| Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments, W83-00018                                    | 5C | <b>CHLOROPHYLL</b><br>Chlorophyll in the Environment, W83-00022  | 5B |  |    |
| Limnological Investigations of a Mountain Spring Pond in the Swiss National Park, W83-00034  | 2H | <b>CHLOROPHYLL</b><br>Chlorophyll in the Environment, W83-00022  | 5B |  |    |
| Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer, W83-00040  | 2H | <b>CHLOROPHYLL</b><br>Chlorophyll in the Environment, W83-00022  | 5B |  |    |
| Phytoplankton Contribution to Alkaline Phosphatase Activity, W83-00041   | 2H | <b>CHLOROPHYLL</b><br>Chlorophyll in the Environment, W83-00022  | 5B |  |    |
| The Sediments of the New Artificial Lake Bosstalsee (Saarland, Germany), with Particular Reference to Microbial Activity, W83-00048        | 5C | <b>CHLOROPHYLL</b><br>Chlorophyll in the Environment, W83-00022  | 5B |  |    |

## SUBJECT INDEX

### BRUSH CONTROL

|  |    |   |    |   |    |
|--|----|---|----|---|----|
| Water Yield Changes Resulting from Treatment of Arizona Chaparral, W83-00303   | 3B | <b>CARONI RIVER</b><br>The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela, W83-00187   | 5B | <b>CHEMICAL ANALYSIS</b><br>Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data, W83-00058 | 7C |
| <b>BRUSSELS</b><br>The Water Supply of the Brussels Urban Area and its Surroundings, W83-00020                                       | 5F | <b>CASE STUDIES</b><br>Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240                                     | 6B | Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington, W83-00112                                    | 2K |
| <b>BY-PRODUCT RECOVERY</b><br>Recycling of Mercury and Silver from COD Tests, W83-00145  | 5D | <b>CATCHMENT BASINS</b><br>Soil Survey of the Experimental Catchments Near Bethlehem, W83-00087   | 4D | Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters, W83-00127  | 2K |
| <b>CALIFORNIA</b><br>Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage, W83-00023                      | 5G | <b>CATIONS</b><br>Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses, W83-00037  | 2H | Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy, W83-00231  | 5A |
| An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979, W83-00064                      | 5B | Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique), W83-00047   | 5A | The Chemical Composition of Water and the Analytical Chemist: A Challenge, W83-00290  | 5A |
| In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light, W83-00141   | 5C | <b>CELLULOSE</b><br>Investigations on Cellulose Biodegradation in Activated Sludge Plants, W83-00013  | 5D | <b>CHEMICAL COAGULATION</b><br>Rapid-Mix Design for Mechanisms of Alum Coagulation, W83-00170   | 5F |
| An Alternative to the Peripheral Canal, W83-00193  | 6G | <b>CERATIUM HIRUNDINELLA</b><br>Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy, W83-00052                              | 5C | Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation, W83-00177   | 5D |
| Role of Fungi in Postfire Stabilization of Chaparral Ash Beds, W83-00302   | 4D | <b>CHANNEL MORPHOLOGY</b><br>Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin, W83-00121                           | 4D | <b>CHEMICAL COMPOSITION</b><br>Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses, W83-00037   | 2H |
| Erosion and Sedimentation as Part of the Natural System, W83-00305   | 2J | Streamflows and Channels of the Green River Basin, Wyoming, W83-00122   | 4A | Structural Characterization of Aquatic Humic Material, W83-00190  | 5C |
| Estimating Hydrologic Values for Planning Wildland Fire Protection, W83-00306  | 6B | <b>CHANNELS</b><br>Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing, W83-00111 | 4D | Daily Chemical Variability of Domestic Septic Tank Effluent, W83-00328  | 5D |
| Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral, W83-00307   | 2I | <b>CHAPARRAL</b><br>Angora Goats for Conversion of Arizona Chaparral: Early Results, W83-00299  | 3B | <b>CHEMICAL OXYGEN DEMAND</b><br>Recycling of Mercury and Silver from COD Tests, W83-00145  | 5D |
| <b>CANADA</b><br>The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment, W83-00042                      | 5C | Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral, W83-00300  | 5B | <b>CHEMICAL PROPERTIES</b><br>Water Quality of Streams in the Great Smoky Mountain National Park, W83-00032                             | 5B |
| Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy, W83-00052                           | 5C | <b>CHLORINATION</b><br>Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona, W83-00301                        | 4D | The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela, W83-00187  | 5B |
| Water and Waste Management in the Canadian Meat and Poultry Processing Industry, W83-00082   | 3E | Water Yield Changes Resulting from Treatment of Arizona Chaparral, W83-00303  | 3B | <b>CHEMICAL TREATMENT</b><br>Chemical Stability of Water, W83-00091   | 5F |
| <b>CANALS</b><br>Aquatic Weed Control with Endothall in a Salt River Project Canal, W83-00166  | 4A | Erosion and Sedimentation as Part of the Natural System, W83-00305  | 2J | <b>CHEMISTRY OF PRECIPITATION</b><br>Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment, W83-00323 | 2K |
| High Plains - Ogallala Aquifer Study Water Transfer Element, W83-00312   | 4A | Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral, W83-00307                                      | 2I | <b>CHLORINATION</b><br>Disinfection, Odor Prevention and Control, W83-00154   | 5D |
| <b>CARBON CYCLE</b><br>Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data, W83-00174 | 5B | Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates, W83-00246   | 3A |   |    |
| <b>CARCINOGENS</b><br>Adsorption of Toxic and Carcinogenic Compounds from Water, W83-00171   | 5F | Disinfection, Taste and Odor Control, W83-00341   | 5F |   |    |
| Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalve Molluscs from Oregon Estuaries, W83-00295          | 5C | <b>CHLOROPHYLL</b><br>Components Contributing to Light Extinction in Natural Water: Method of Isolation, W83-00213  | 5A |   |    |
|  |    | <b>CHLOROPHYLL A</b><br>In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light, W83-00141  | 5C |   |    |

## SUBJECT INDEX

### CONVEYANCE STRUCTURES

#### CHROMATOGRAPHY

Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography,  
W83-00014

5A

Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultra-violet Detection,  
W83-00202

5A

The Chemical Composition of Water and the Analytical Chemist: A Challenge,  
W83-00290

5A

Determination of Benzidines in Industrial and Municipal Wastewaters,  
W83-00292

5A

#### CHROMIUM

Impact of Chromium to the Population Dynamics of Tisbe Holothuriae,  
W83-00043

5C

#### CLAMS

Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,  
W83-00159

5C

Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalve Molluscs from Oregon Estuaries,  
W83-00295

5C

#### CLARIFICATION

Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,  
W83-00179

5D

#### CLARIFIED WASTEWATER

Cause of Inefficient Solids Separation in the Activated Sludge Process,  
W83-00232

5D

#### CLARIFIERS

High-Quality Trickling Filter Effluent Without Tertiary Treatment,  
W83-00142

5D

#### CLEANING

Sewer Maintenance and Rehabilitation.  
W83-00156

5D

System Maintenance.  
W83-00339

8A

#### CLEAR-CUTTING

Developing a USLE Cover-Management (C) Factor Procedure for Forest Conditions,  
W83-00108

4D

#### CLIMATIC DATA

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980,  
W83-00074

7C

Climatic Aspects of Droughts,  
W83-00188

3F

#### CLOSED SYSTEMS

Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems,  
W83-00324

5G

#### CLOUD SEEDING

The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,  
W83-00084

2B

#### COAL MINES

Sludge Disposal from Acid Mine Drainage Treatment,  
W83-00298

5E

#### COAL MINING

The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,  
W83-00223

6G

#### COASTAL POLLUTION

Municipal Point Source and Agricultural Non-point Source Contribution to Coastal Eutrophication,  
W83-00001

5B

#### COLIFORMS

Coliform Attachment to Suspended Particles in Stormwater,  
W83-00224

5B

#### COLIPHAGES

Increasing Arcat Test Sensitivity for Examination of Potable Waters,  
W83-00293

5F

#### COLORADO

Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado,  
W83-00077

7C

Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,  
W83-00124

5A

Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado,  
W83-00168

4C

#### COLUMBIA GLACIER

Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,  
W83-00119

2C

#### COMBINED SEWER OVERFLOWS

Management and Control Technology for Urban Stormwater Pollution,  
W83-00148

5G

#### COMPACTATION

Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,  
W83-00075

7C

#### COMPUTER MODELS

Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana,  
W83-00109

4B

Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,  
W83-00118

2C

Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,  
W83-00119

2C

#### CONTINUITY EQUATION

Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,  
W83-00118

2C

#### CONTRACTS

Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View,  
W83-00135

5F

#### CONVEYANCE STRUCTURES

Mains and Services.  
W83-00313

8C

#### Collection Systems.

W83-00338

8C

#### System Maintenance.

W83-00339

8A

## SUBJECT INDEX

### COPEPODS

**COPEPODS**  
Impact of Chromium to the Population Dynamics of *Tisbe Holothuriae*,  
W83-00043 5C

### COPPER

Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in *Tjeukemeer*, the Netherlands,  
W83-00039 5B

Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,  
W83-00079 5G

### CORROSION CONTROL

Chemical Stability of Water.  
W83-00091

Cathodic Protection of Water Mains,  
W83-00175 8G

### CORROSIVE WATER

New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,  
W83-00137 5G

### COST ALLOCATION

Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,  
W83-00005 6B

### COST ANALYSIS

Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View,  
W83-00135 5F

Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs,  
W83-00147 5G

Incentives for Irrigation Water Conservation in Agriculture,  
W83-00278 3F

### CREAMS

Estimating Sediment Yield from Rangeland with CREAMS,  
W83-00103 2J

### CROP PRODUCTION

Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,  
W83-00230 3F

Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,  
W83-00233 5E

Conservation Through Crops Research,  
W83-00311 3F

### CROP YIELD

Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,  
W83-00234 3F

Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,  
W83-00235 3F

A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,  
W83-00287 2D

### CROPLAND

Spreading Lagooned Sewage Sludge on Farmland: A Case History,  
W83-00296 5E

### CULTIVATE LANDS

Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,  
W83-00233 5E

### CULTURES

Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,  
W83-00219 5B

### CULVERTS

Drainage and Structures.  
W83-00334 8A

### CYANOPHYTA

Excretion and DOC Utilization by *Oscillatoria Rubescens* D.C. and its Accompanying Micro-Organisms,  
W83-00183 5C

### DAILY HYDROGRAPHS

Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,  
W83-00282 2E

### DAM DESIGN

Kielder - Planning to Meet the Future.  
W83-00207 8A

### DAM EFFECTS

Environmental Impact of Large Hydroelectric Projects on Tropical Countries,  
W83-00010 6G

Final Environmental Impact Statement of the White River Dam Project.  
W83-00297 6G

### DAM FAILURE

The Flow of Slurry from a Breached Tailings Dam,  
W83-00285 8B

### DAM SAFETY

Plumbline Monitor Interface,  
W83-00094 8G

### DATA ACQUISITION

U.S. Geological Survey Federal-State Program,  
W83-00201 6E

### DATA COLLECTIONS

Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data.  
W83-00058 7C

Manual for Leveling at Gaging Stations in North Carolina,  
W83-00065 7B

Water-Resources Investigations of the U.S. Geological Survey in New Mexico, Fiscal Year 1980.  
W83-00073 7A

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980,  
W83-00074 7C

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma,  
W83-00110 7C

Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,  
W83-00124 5A

U.S. Geological Survey Federal-State Program,  
W83-00201 6E

A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,  
W83-00289 2B

### DATA INTERPRETATION

A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,  
W83-00289 2B

### DATA PROCESSING

Trade Effluent Control and the Microprocessor,  
W83-00003 5G

### DATA TRANSMISSION

Policy Objectives and Information System for Irrigation Projects-India,  
W83-00011 6A

### DECISION MAKING

Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I,  
W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II,  
W83-00274 10D

### DECOMPOSITION

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,  
W83-00345 2H

### DELTAS

An Alternative to the Peripheral Canal,  
W83-00193 6G

### DENITRIFICATION

Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments,  
W83-00018 5C

Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,  
W83-00264 5B

### DENITRIFYING BACTERIA

Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments,  
W83-00018 5C

### DEPTH-AREA-DURATION ANALYSIS

A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,  
W83-00289 2B

### DES MOINES RIVER

Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,  
W83-00248 4A

### DESALINATION

Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,  
W83-00222 3A

Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems,  
W83-00244 3A

Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,  
W83-00256 3A

Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,  
W83-00259 3A

Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities,  
W83-00261 3A

Development of Composite Hollow Fibers - Phase III,  
W83-00267 3A

## SUBJECT INDEX

### ENGLAND

|  |   |    |
|--|---|----|
| <b>DIATOMITE PRECOAT FILTRATION</b>                                      | Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis, W83-00270   | 3A |
| <b>USE OF THE WATER-SALT BALANCE METHOD</b>                              | Use of the Water-Salt Balance Method for Calculating the Desalination Regime of a Large Water Body, W83-00322   | 5G |
| <b>DESALINATION APPARATUS</b>  | Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device, W83-00256  | 3A |
| <b>DESIGN CRITERIA</b>   | Development of Composite Hollow Fibers - Phase III, W83-00267   | 3A |
| <b>DETERGENTS</b>  | Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities, W83-00261   | 3A |
| <b>ASSESSMENT OF LOW HEAD, MICRO HYDROELECTRIC EQUIPMENT</b>             | Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands, W83-00268  | 8C |
| <b>BLACKHEATH WATER TREATMENT PLANT</b>                                  | Blackheath Water Treatment Plant, W83-00283   | 5F |
| <b>A WEIGHING LYSIMETER FACILITY</b>                                     | A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies, W83-00287  | 2D |
| <b>DETERRITUS</b>  | Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada, W83-00070  | 2E |
| <b>DEVELOPING COUNTRIES</b>  | Developing and Applying International Water Quality Guidelines, W83-00167   | 5G |
| <b>DIATOMACEOUS EARTH</b>  | Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis, W83-00270   | 3A |
| <b>DISINFECTION</b>  | Disinfection, Odor Prevention and Control, W83-00154  | 5D |
| <b>WASTEWATER FLOCCULATION-FILTRATION</b>                                | Wastewater Flocculation-Filtration and Post Disinfection, W83-00239   | 5D |
| <b>INCREASING ARCAT TEST SENSITIVITY</b>                                 | Increasing Arcat Test Sensitivity for Examination of Potable Waters, W83-00293  | 5F |
| <b>DISINFECTION, TASTE AND ODOR CONTROL</b>                              | Disinfection, Taste and Odor Control, W83-00341   | 5F |
| <b>DISSOLVED ORGANIC MATTER</b>  | Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms, W83-00183  | 5C |
| <b>DISTRICT OF COLUMBIA</b>  | Reservoir Management in Potomac River Basin, W83-00203  | 6A |
| <b>A CURRICULUM FOR WATER SUPPLY AND WASTEWATER OPERATION</b>            | A Curriculm for Water Supply and Wastewater Operation, Maintenance and Management, W83-00247  | 5G |
| <b>DIURNAL DISTRIBUTION</b>  | Diurnal Periodicity in the Chemical Composition of Lake Phytoplankton, W83-00049  | 5B |
| <b>DIURON</b>  | Aerobic Degradation of Diuron by Aquatic Microorganisms, W83-00002  | 5B |
| <b>DOMESTIC WASTES</b>   | Daily Chemical Variability of Domestic Septic Tank Effluent, W83-00328  | 5D |
| <b>DRAINAGE</b>  | Adjustment of Soil Limitations, W83-00286   | 2G |
| <b>DRAINAGE EFFECTS</b>  | Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields, W83-00228                                       | 5B |
| <b>DRAINAGE ENGINEERING</b>  | Drainage and Structures, W83-00334  | 8A |
| <b>DRAINAGE SYSTEMS</b>  | Drainage and Structures, W83-00334  | 8A |
| <b>DREDGING</b>  | The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective, W83-00210   | 5G |
| <b>DRINKING WATER</b>  | Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts, W83-00139   | 5B |
| <b>DEVELOPING AND APPLYING INTERNATIONAL WATER QUALITY GUIDELINES</b>    | Developing and Applying International Water Quality Guidelines, W83-00167   | 5G |
| <b>WEST RIVER GETS INNOVATIVE TECHNOLOGY</b>                             | West River Gets Innovative Technology, W83-00197  | 5F |
| <b>WATER TREATMENT FOR SMALL PUBLIC SUPPLIES</b>                         | Water Treatment for Small Public Supplies, W83-00280  | 5F |
| <b>POLYCYCLIC AROMATIC HYDROCARBONS IN SEWAGE, MUSSELS AND TAP WATER</b> | Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water, W83-00330  | 5B |
| <b>WATER SUPPLY AND TREATMENT, SECTION C-1, RAW WATER PREPARATION</b>    | Water Supply and Treatment, Section C-1, Raw Water Preparation, W83-00335   | 5F |
| <b>DISINFECTION, TASTE AND ODOR CONTROL</b>                              | Disinfection, Taste and Odor Control, W83-00341   | 5F |
| <b>SOFTENING, IRON AND MANGANESE REMOVAL</b>                             | Softening, Iron and Manganese Removal, W83-00342  | 5F |
| <b>DROUGHT</b>   | Social and Political Aspects of Drought, W83-00186  | 6B |
| <b>CLIMATIC ASPECTS OF DROUGHTS</b>                                      | Climatic Aspects of Droughts, W83-00188   | 3F |
| <b>WATER RESOURCE SYSTEM RELIABILITY</b>                                 | Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study, W83-00229  | 3D |
| <b>STOCHASTIC DAILY PRECIPITATION MODELING</b>                           | Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes, W83-00282  | 2E |
| <b>DYE INDUSTRY WASTES</b>   | Determination of Benzidines in Industrial and Municipal Wastewaters, W83-00292  | 5A |
| <b>DYE RELEASES</b>  | Streamflows and Channels of the Green River Basin, Wyoming, W83-00122   | 4A |
| <b>EARTH DAMS</b>  | Kielder - Planning to Meet the Future, W83-00207  | 8A |
| <b>ECOLOGICAL EFFECTS</b>  | Irrigation Planning in the Tana Basin of Kenya, W83-00015   | 6B |
| <b>ECONOMIC ASPECTS</b>  | Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands, W83-00035   | 2L |
| <b>ECONOMIC IMPACT</b>   | The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation, W83-00016   | 6A |
| <b>THE OGALLALA-HALF FULL OR HALF EMPTY</b>                              | The Ogallala-Half Full or Half Empty, W83-00017   | 6D |
| <b>A COOPERATIVE WATER RESOURCE TECHNOLOGY TRANSFER PROGRAM</b>          | A Cooperative Water Resource Technology Transfer Program, W83-00216   | 6B |
| <b>ECOSYSTEMS</b>  | The Ecology of the Mangroves of South Florida: A Community Profile, W83-00093   | 6G |
| <b>PERSISTENCE IN MODEL ECOSYSTEMS</b>                                   | Persistence in Model Ecosystems, W83-00294  | 5B |
| <b>EDUCATION</b>   | A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management, W83-00247   | 5G |
| <b>EFFLUENT CHARGES</b>  | Trade Effluent Control and the Microprocessor, W83-00003  | 5G |
| <b>EFFLUENTS</b>   | Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida, W83-00068   | 5B |
| <b>ELECTRODIALYSIS</b>   | Water Treatment for Small Public Supplies, W83-00280  | 5F |
| <b>ENERGY RECOVERY</b>   | Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device, W83-00256  | 3A |
| <b>ENGLAND</b>   | The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England, W83-00012  | 5B |
| <b>DIURNAL PERIODICITY</b>   | Diurnal Periodicity in the Chemical Composition of Lake Phytoplankton, W83-00049  | 5B |
| <b>THE DEVELOPMENT OF ATTENUANCE DEPTH-PROFILING</b>                     | The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake, W83-00055 | 5C |
| <b>ACCURACY OF DETERMINATION OF AMMONIACAL NITROGEN IN RIVER WATERS</b>  | Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme, W83-00196                               | 5A |

## SUBJECT INDEX

### ENVIRONMENTAL EFFECTS

#### ENVIRONMENTAL EFFECTS

The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent, W83-00084 2B

Final Environmental Impact Statement of the White River Dam Project, W83-00297 6G

High Plains - Ogallala Aquifer Study Water Transfer Element, W83-00312 4A

#### ENVIRONMENTAL IMPACT STATEMENT

Final Environmental Impact Statement of the White River Dam Project, W83-00297 6G

#### ENVIRONMENTAL TRACERS

Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land, W83-00264 5B

Groundwater in the Inner Bluegrass Karst Region, Kentucky, W83-00275 2F

#### ENZYMES

Induction of High Phosphatase Activity by Aluminum in Acid Lakes, W83-00029 5B

Phytoplankton Contribution to Alkaline Phosphatase Activity, W83-00041 2H

Characterization of Acid Phosphatases in the Acidified Lake Gardsjön, Sweden, W83-00050 5C

#### EROSION CONTROL

Relation of USLE Factors to Erosion on Rangeland, W83-00096 2J

Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa, W83-00218 4D

Role of Fungi in Postfire Stabilization of Chaparral Ash Beds, W83-00302 4D

#### EROSION INDEX

The USLE Rainfall Factor for Southwestern U. S. Rangelands, W83-00098 4D

#### EROSION RATES

The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation, W83-00140 2J

#### ESCAMBIA BAY

Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water, W83-00211 5B

#### ESTIMATED COSTS

Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands, W83-00268 8C

#### ESTUARIES

Municipal Point Source and Agricultural Non-point Source Contribution to Coastal Eutrophication, W83-00001 5B

An Alternative to the Peripheral Canal, W83-00193 6G

#### ESTUARINE ENVIRONMENT

Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters, W83-00263 5C

#### EUTROPHIC LAKES

Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques, W83-00006 5C

The Sediments of the New Artificial Lake Bostalsee (Saarland, Germany), with Particular Reference to Microbial Activity, W83-00048 5C

Diel Periodicity in the Chemical Composition of Lake Phytoplankton, W83-00049 5B

Seasonal Abundance of Ceratium Hirundinella, (O.F. Müller) Schrank in Lakes of Different Trophic, W83-00052 5C

Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms, W83-00183 5C

Phosphate and Wind in a Shallow Lake, W83-00184 5B

Lake Restoration Technology Transfer Assessment, W83-00215 5G

An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation, W83-00245 5G

#### EUTROPHICATION

Municipal Point Source and Agricultural Non-point Source Contribution to Coastal Eutrophication, W83-00001 5B

Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs, W83-00009 5C

Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes, W83-00025 5C

Paleoecological Studies of the Recent Development of the Lake Vaxjösjön. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids, W83-00028 5C

The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance, W83-00036 2H

The Sediments of the New Artificial Lake Bostalsee (Saarland, Germany), with Particular Reference to Microbial Activity, W83-00048 5C

Seasonal Abundance of Ceratium Hirundinella, (O.F. Müller) Schrank in Lakes of Different Trophic, W83-00052 5C

Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters, W83-00263 5C

The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species, W83-00288 5C

The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret, W83-00333 5C

#### EVAPORATION RATE

Pine Tree Evapotranspiration, W83-00279 2D

#### EVAPORATORS

Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222 3A

#### EVAPOTRANSPIRATION

Pine Tree Evapotranspiration, W83-00279 2D

#### EVAPOTRANSPIRATION POTENTIAL

A Weighing Lysimeter Facility at Rodeoplaat for Crop Evapotranspiration Studies, W83-00287 2D

#### EVAPOTRANSPIRATION

Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed, W83-00346 2D

#### EXCRETION

Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms, W83-00183 5C

#### FARM WASTES

Municipal Point Source and Agricultural Non-point Source Contribution to Coastal Eutrophication, W83-00001 5B

#### FATE OF POLLUTANTS

Aerobic Degradation of Diuron by Aquatic Microorganisms, W83-00002 5B

The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England, W83-00012 5B

#### WATER CHARACTERISTICS

W83-00169 5B

#### PERSISTENCE IN MODEL ECOSYSTEMS

W83-00294 5B

#### FATTY ACIDS

Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips, W83-00326 5D

#### FEASIBILITY STUDIES

Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis, W83-00251 2E

Evaluation of Limnological Parameters as Related to the Success of Mysis relicta Introductions, W83-00254 8I

Development of Composite Hollow Fibers - Phase III, W83-00267 3A

Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands, W83-00268 8C

#### FEEDLOT WASTES

Stabilizing High-Strength Wastes with Photosynthetic Bacteria, W83-00181 5D

#### FILMS

Fixed-Film Biological Processes, W83-00191 5D

#### FILTRATION

West River Gets Innovative Technology, W83-00197 5F

New Technology for Drinking Water Treatment, W83-00198 5F

## SUBJECT INDEX

### FOAM SEPARATION

|   |    |   |    |  |    |
|---|----|---|----|--|----|
| Wastewater Flocculation-Filtration and Post Disinfection,<br>W83-00239  | 5D | Wastewater Flocculation-Filtration and Post Disinfection,<br>W83-00239  | 5D | Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,<br>W83-00211 | 5B |
| Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,<br>W83-00270                              | 3A | <b>FLOOD FLOW</b>   |    | Water Quality Criteria and Effluent Requirements in Broward County, Florida,<br>W83-00320  | 5G |
| <b>FINANCIAL FEASIBILITY</b>  |    | Floodflow Characteristics Related to Channel Geometry in Ohio,<br>W83-00067   | 2E | Advanced Biological Treatment to Achieve Nutrient Removal,<br>W83-00349  | 5D |
| Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,<br>W83-00270                              | 3A | <b>FLOOD FORECASTING</b>  |    | <b>FLOTATION</b>   |    |
| <b>FINITE ELEMENT METHOD</b>  |    | The Statistics of Extreme Values and the Analyses of Floods in South Africa,<br>W83-00089   | 2E | Textile Industry Wastewater Treatment by Air Flotation,<br>W83-00080   | 5D |
| Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,<br>W83-00118                                       | 2C | <b>FLOOD FREQUENCY</b>  |    | Improvements in Foam Flotation for Lead Removal,<br>W83-00150  | 5D |
| <b>FINLAND</b>  |    | Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,<br>W83-00071  | 2E | Algae Removal by Induced Air Flotation,<br>W83-00277   | 5G |
| Dynamics of Phytoplankton in Finnish Lakes,<br>W83-00153  | 5C | <b>FLOOD PEAK</b>   |    | <b>FLOW CHARACTERISTICS</b>  |    |
| The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,<br>W83-00332  | 5B | Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,<br>W83-00071  | 2E | Low-Flow Characteristics and Flow Duration of New Jersey Streams,<br>W83-00061   | 7C |
| <b>FIRE</b>   |    | <b>FLOOD PLAIN MANAGEMENT</b>   |    | Floodflow Characteristics Related to Channel Geometry in Ohio,<br>W83-00067  | 2E |
| Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,<br>W83-00302   | 4D | Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,<br>W83-00005  | 6B | Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin,<br>W83-00121                      | 4D |
| Estimating Hydrologic Values for Planning Wildland Fire Protection,<br>W83-00306  | 6B | <b>FLOODS</b>   |    | Streamflows and Channels of the Green River Basin, Wyoming,<br>W83-00122   | 4A |
| <b>FISH ATTRACTANTS</b>   |    | Floodflow Characteristics Related to Channel Geometry in Ohio,<br>W83-00089   | 2E | The Flow of Slurry from a Breached Tailings Dam,<br>W83-00285  | 8B |
| Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,<br>W83-00255       | 8I | Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,<br>W83-00071  | 2E | <b>FLOW DISCHARGE</b>  |    |
| <b>FISH BEHAVIOR</b>  |    | The Statistics of Extreme Values and the Analyses of Floods in South Africa,<br>W83-00089   | 2E | Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,<br>W83-00095  | 7C |
| Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,<br>W83-00255       | 8I | Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,<br>W83-00128  | 4A | <b>FLOW DURATION</b>   |    |
| <b>FISH MIGRATION</b>   |    | Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,<br>W83-00282   | 2E | Low-Flow Characteristics and Flow Duration of New Jersey Streams,<br>W83-00061   | 7C |
| Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,<br>W83-00255       | 8I | Estimating Hydrologic Values for Planning Wildland Fire Protection,<br>W83-00306  | 6B | Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,<br>W83-00251  | 2E |
| <b>FISH POPULATIONS</b>   |    | <b>FLOODWATER</b>   |    | <b>FLOW INJECTION ANALYSIS</b>   |    |
| Evaluation of Limnological Parameters as Related to the Success of Mysis Relicta Introductions,<br>W83-00254                  | 8I | Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,<br>W83-00230   | 3F | Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,<br>W83-00194             | 5A |
| Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,<br>W83-00255       | 8I | <b>FLORIDA</b>  |    | <b>FLOW MEASUREMENT</b>  |    |
| Instream Salmonid Habitat Exclusion by Ice-Cover,<br>W83-00257  | 8I | Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,<br>W83-00068  | 5B | Operation Control,<br>W83-00155  | 5G |
| Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II,<br>W83-00272              | 4A | The Ecology of the Mangroves of South Florida: A Community Profile,<br>W83-00093  | 6G | Intensive Flow Monitoring-Cost-Effectiveness with a Quality Edge,<br>W83-00200   | 5G |
| <b>FISH TOXINS</b>  |    | Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980,<br>W83-00113   | 7C | <b>FLUORESCENCE</b>  |    |
| The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,<br>W83-00332  | 5B | Deep Artesian Aquifers Sanibel and Captiva Islands, Lee County, Florida,<br>W83-00114   | 4B | In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,<br>W83-00141  | 5C |
| <b>FLASH FLOODS</b>   |    | Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,<br>W83-00129   | 5B | <b>FLUORIDES</b>   |    |
| Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada,<br>W83-00070 | 2E | Estimated Effects of Projected Ground-Water With-Drawals on Movement of the Saltwater Front in the Floridian Aquifer, 1976-2000, West-Central Florida,<br>W83-00130 | 4B | Softening, Iron and Manganese Removal,<br>W83-00342  | 5F |
| <b>FLUCCULATION</b>   |    | <b>FOAM SEPARATION</b>  |    | Improvements in Foam Flotation for Lead Removal,<br>W83-00150  | 5D |
| Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,<br>W83-00177                                | 5D |   |    |  |    |

## SUBJECT INDEX

### FOAMING

**FOAMING**  
Algae Removal by Induced Air Flotation, W83-00277

5G

### FOOD-PROCESSING WASTES

Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System, W83-00317

5D

### FORECASTING

Practical Techniques of River Monitoring and Pollution Forecasting, W83-00238

5B

### FOREST MANAGEMENT

Developing a USLE Cover-Management Factor Procedure for Forest Conditions, W83-00108

4D

### FOSSILS

Paleoecological Studies of the Recent Development of the Lake Vaxjosjon. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids, W83-00028

5C

### FOULING

Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems, W83-00244

3A

### FRACTURE SPRINGS

Use of Fracture Traces in Water Well Location: a Handbook, W83-00217

4B

### FREQUENCY ANALYSIS

Low Flow of Streams in Fairfax County, Virginia, W83-00062

4C

### FURROW IRRIGATION

Water Saving Techniques, W83-00309

3F

### GAS CHROMATOGRAPHY

Multiple Purge Techniques for Determining Organic Pollutants in Groundwater, W83-00158

5A

Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection, W83-00182

5A

### GEOHYDROLOGY

Geohydrology of Southwestern Kansas, W83-00059

7C

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma, W83-00110

7C

Groundwater in the Inner Bluegrass Karst Region, Kentucky, W83-00275

2F

### GEOLOGIC FRACTURES

Use of Fracture Traces in Water Well Location: a Handbook, W83-00217

4B

### GEOLOGIC MAPPING

Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069

7C

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-00116

7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York, W83-00117

7C

Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota, W83-00236

5E

### GEORGIA

Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake, W83-00044

2H

### GEOTHERMAL STUDIES

Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters, W83-00127

2K

### GLACIER MASS BALANCE

Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska, W83-00119

2C

### GLACIERS

Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska, W83-00118

2C

Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska, W83-00119

2C

### GOATS

Angora Goats for Conversion of Arizona Chaparral: Early Results, W83-00299

3B

### GRAIN CROPS

Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield, W83-00234

3F

### GRAPHICAL ANALYSIS

Soil Maps of Montana, W83-00237

7C

### GRAPHICAL METHODS

Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I, W83-00273

10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II, W83-00274

10D

### GRASS CARP

Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II, W83-00272

4A

### GRAZING

Use of Erosion Models on Western Rangelands, W83-00097

2J

Predicting Sediment Yields from Sagebrush Rangelands, W83-00106

4D

### GROUNDWATER

Water Resources Data, Louisiana, Water Year 1981-Volume 2. Southern Louisiana, W83-00057

7C

Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data, W83-00058

7C

Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee, W83-00066

5B

Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida, W83-00068

5B

Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069

7C

Water-Resources Investigations of the U.S. Geological Survey in New Mexico, Fiscal Year 1980, W83-00073

7A

Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas, W83-00075

7C

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana, W83-00076

7C

Applications of Digital Modeling for Evaluating the Ground-Water Resources of the 2,000-Foot Sand of the Baton Rouge Area, Louisiana, W83-00109

4B

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma, W83-00110

7C

Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida, W83-00114

4B

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-00116

7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York, W83-00117

7C

Summary Appraisals of the Nation's Ground-Water Resources-New England Region, W83-00120

4B

Designation of Principal Water-Supply Aquifers in Minnesota, W83-00125

2F

Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida, W83-00129

5B

Estimated Effects of Projected Ground-Water Withdrawals on Movement of the Saltwater Front in the Floridian Aquifer, 1976-2000, West-Central Florida, W83-00130

4B

Water Resources Data for New York, Water Year 1981-Volume 3. Western New York, W83-00131

7C

Water Resources Data for North Carolina, Water Year 1981, W83-00132

7C

GROUNDWATER AVAILABILITY  
Use of Fracture Traces in Water Well Location: a Handbook, W83-00217

4B

GROUNDWATER BASINS  
Groundwater in the Inner Bluegrass Karst Region, Kentucky, W83-00275

2F

GROUNDWATER DEPLETION  
The Ogallala-Half Full or Half Empty., W83-00017

6D

## SUBJECT INDEX

## HYDROLOGIC DATA

### GROUNDWATER MINING

Groundwater is the Answer to Zambia's Water Problem,  
W83-00225

4B

### GROUNDWATER MOVEMENT

Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,  
W83-00069

7C

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,  
W83-00116

7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York,  
W83-00117

7C

Tracing Well Water Pollution in a Limestone Aquifer,  
W83-00173

5B

A Preliminary Study of Natural Aquifer Discharge of Guam,  
W83-00271

5B

Groundwater in the Inner Bluegrass Karst Region, Kentucky,  
W83-00275

2F

### GROUNDWATER POLLUTION

Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant,  
W83-00019

5B

Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,  
W83-00158

5A

Tracing Well Water Pollution in a Limestone Aquifer,  
W83-00173

5B

Control Measures for Groundwater VOCs,  
W83-00199

5F

The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,  
W83-00220

5E

Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields,  
W83-00228

5B

The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,  
W83-00258

5G

A Preliminary Study of Natural Aquifer Discharge of Guam,  
W83-00271

5B

### GROUNDWATER POTENTIAL

Geohydrology of Southwestern Kansas,  
W83-00059

7C

### GUAM

A Preliminary Study of Natural Aquifer Discharge of Guam,  
W83-00271

5B

### GULLS

The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,  
W83-00012

5B

### HALOGENATED PESTICIDES

Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,  
W83-00045

5A

### HAWAII

Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,  
W83-00281

5G

### HAZARDOUS MATERIALS

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,  
W83-00231

5A

### Hazardous Waste Technology Transfer Assessment,

W83-00276

5E

### HAZARDS

Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada,  
W83-00070

2E

### HEAVY METALS

Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,  
W83-00159

5C

Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,  
W83-00214

5B

The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,  
W83-00327

5D

### HERBICIDES

Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,  
W83-00045

5A

Aquatic Weed Control with Endothall in a Salt River Project Canal,  
W83-00166

4A

The Ecological Effects of 2-Methylthiotaiazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,  
W83-00343

5C

### HEXAGENIA

Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,  
W83-00030

5C

### HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography,  
W83-00014

5A

### HIGHWAY ICING

Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,  
W83-00227

5C

### HISTORY

Ho. For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,  
W83-00253

6B

### HOLLOW FIBERS

Development of Composite Hollow Fibers - Phase III,  
W83-00267

3A

### HUMIC ACIDS

Adsorption of PAH to Aquatic Humus,  
W83-00038

5B

Structural Characterization of Aquatic Humic Material,  
W83-00190

5C

### HUMUS SLUDGE

Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,  
W83-00284

5D

### HURON RIVER

Association Studies of Polybrominated Biphenyls in Aquatic Systems,  
W83-00160

5B

### HYDRAULIC PROPERTIES

The Flow of Slurry from a Breached Tailings Dam,  
W83-00285

8B

### HYDRAULIC STRUCTURES

A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,  
W83-00289

2B

### HYDROELECTRIC PLANTS

Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,  
W83-00268

8C

Final Environmental Impact Statement of the White River Dam Project.  
W83-00297

6G

### HYDROELECTRIC POWER

Environmental Impact of Large Hydroelectric Projects on Tropical Countries,  
W83-00010

6G

### HYDROGEN ION CONCENTRATION

High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,  
W83-00243

5D

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,  
W83-00331

5C

### HYDROGEN SULFIDE

Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,  
W83-00204

5A

### HYDROGRAPH ANALYSIS

Adaptation of the ILLUDAS Model to a Desktop Computer,  
W83-00081

7B

### HYDROLOGIC ASPECTS

Soil Survey of the Experimental Catchments Near Bethlehem,  
W83-00087

4D

Estimating Hydrologic Values for Planning Wildland Fire Protection,  
W83-00306

6B

### HYDROLOGIC BUDGET

Efficient Use of Water for Irrigation in the Upper Midwest,  
W83-00242

3F

### HYDROLOGIC CYCLE

The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,  
W83-00223

6G

### HYDROLOGIC DATA

Water Resources Data, Louisiana, Water Year 1981-Volume 2. Southern Louisiana.  
W83-00057

7C

### HYDROLOGY OF SOUTHWESTERN KANSAS

Geohydrology of Southwestern Kansas,  
W83-00059

7C

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980,  
W83-00074

7C

## SUBJECT INDEX

### **HYDROLOGIC DATA**

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana, W83-00076 7C

Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado, W83-00077 7C

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico, W83-00078 7C

Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973, W83-00095 7C

Water Resources Data for New York, Water Year 1981—Volume 3. Western New York, W83-00131 7C

Water Resources Data for North Carolina, Water Year 1981, W83-00132 7C

Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis, W83-00251 2E

### **HYDROLOGIC MODELS**

Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado, W83-00168 4C

Efficient Use of Water for Irrigation in the Upper Midwest, W83-00242 3F

IHHR Distributed Parameter Watershed Model, W83-00269 2E

### **HYDROLOGIC REGIME**

Physicochemical Limnology of the Tongue River Reservoir, Montana, W83-00033 2H

### **HYDROLOGIC SYSTEMS**

Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado, W83-00168 4C

### **HYDROTHERMAL STUDIES**

The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada, W83-00060 4B

### **ICE COVER**

Instream Salmonid Habitat Exclusion by Ice-Cover, W83-00257 8I

### **IDAHO**

Predicting Sediment Yields from Sagebrush Rangelands, W83-00106 4D

Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis, W83-00251 2E

### **IHHR WATERSHED MODEL**

IHHR Distributed Parameter Watershed Model, W83-00269 2E

### **INDIA**

Policy Objectives and Information System for Irrigation Projects-India, W83-00011 6A

Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India, W83-00027 2H

### **INDUSTRIAL WASTEWATER**

Trade Effluent Control and the Microprocessor, W83-00003 5G

Textile Industry Wastewater Treatment by Air Flotation, W83-00080 5D

Biooxidation of Paint Process Wastewater, W83-00143 5D

Pulp and Paper Effluent Management, W83-00164 5D

Primary Treatment, W83-00337 5D

Municipal Pretreatment Program Development, W83-00350 5D

### **INFORMATION EXCHANGE**

Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I, W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II, W83-00274 10D

### **INFRARED SPECTROSCOPY**

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy, W83-00231 5A

### **INHIBITORS**

Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222 3A

### **INJECTION WELLS**

Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida, W83-00129 5B

### **INSTITUTIONAL CONSTRAINTS**

Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240 6B

Wastewater Management Problems in Rural Communities, W83-00249 5G

Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska, W83-00250 6E

### **INTAKES**

Water Supply and Treatment, Section C-1, Raw Water Preparation, W83-00335 5F

### **INTERAGENCY COOPERATION**

U.S. Geological Survey Federal-State Program, W83-00201 6E

### **INTERNATIONAL LAW**

The Plight of American Citizens Injured by Transboundary River Pollution, W83-00209 6E

### **INTERSTATE COMPACTS**

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas—Oklahoma, 1980 Water Year, W83-00063 4A

### **INVERTEBRATES**

Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India, W83-00027 2H

Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake, W83-00044 2H

Some Aspects of the Colonization by Water Mites (Acar, Actinedida) of an Artificial Substrate in a Disturbed Environment, W83-00054 5C

### **ION EXCHANGE**

Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities, W83-00261 3A

### **IONS**

Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment, W83-00323 2K

### **IOWA**

Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa, W83-00218 4D

Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis, W83-00241 6A

Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time, W83-00248 4A

IHHR Distributed Parameter Watershed Model, W83-00269 2E

### **IRON**

Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis, W83-00194 5A

Softening, Iron and Manganese Removal, W83-00342 5F

### **IRRIGATION**

Water Saving Techniques, W83-00309 3F

Conservation Through Crops Research, W83-00311 3F

### **IRRIGATION EFFECTS**

Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover), W83-00252 5G

Conservation Through Crops Research, W83-00311 3F

### **IRRIGATION EFFICIENCY**

The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation, W83-00016 6A

Efficient Use of Water for Irrigation in the Upper Midwest, W83-00242 3F

Water Saving Techniques, W83-00309 3F

Irrigation Scheduling, W83-00310 3F

### **IRRIGATION PRACTICES**

Policy Objectives and Information System for Irrigation Projects-India, W83-00011 6A

Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield, W83-00234 3F

## SUBJECT INDEX

### LAND DISPOSAL

|   |    |   |  |  |  |   |
|---|----|---|--|--|--|---|
| Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I, W83-00235                                   | 3F | KINETIC ENERGY                                      | The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation, W83-00140                         | 2J   | of the Eutrophication Process Through the Analysis of Subfossil Chironomids, W83-00028   | 5C  |
| Incentives for Irrigation Water Conservation in Agriculture, W83-00278  | 3F | KINETICS  | A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters, W83-00138   | 5D   | Effects of the Burrowing Mayfly, <i>Hexagenia</i> , on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms, W83-00030        | 5C  |
| A Weighing Lysimeter Facility at Rooderplaat for Crop Evapotranspiration Studies, W83-00287   | 2D | MINERALIZATION                                      | Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water, W83-00211            | 5B   | Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake, W83-00044                                      | 2H  |
| Irrigation Scheduling, W83-00310  | 3F | LABORATORY EQUIPMENT                                | Operation Control, W83-00155   | 5G   | The Sediments of the New Artificial Lake Boslalsee (Saarland, Germany), with Particular Reference to Microbial Activity, W83-00048 | 5C  |
| <b>IRRIGATION PROGRAMS</b>  |    | Metering, Monitoring and Quality Control, W83-00336 | 8G   | Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms, W83-00214 | 5B   |   |
| Irrigation Planning in the Tana Basin of Kenya, W83-00015   | 6B | <b>LAKE CONSTANCE</b>                               | The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance, W83-00036 | 2H   | Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy), W83-00316           | 2H  |
| <b>IRRIGATION SCHEDULING</b>  |    | <b>LAKE KINNERET</b>                                | The Relationship Between Nutrient Status and Chemical Composition of <i>Peridinium cinctum</i> During the Bloom in Lake Kinneret, W83-00333      | 5C   | LAKE SHORES  | Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa, W83-00218                             |
| Irrigation Scheduling, W83-00310  | 3F | <b>LAKE KIZAKI</b>                                  | Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton, W83-00344   | 2H   | LAKE TAHOE   | In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light, W83-00141  |
| <b>ISOTOPE FRACTIONATION</b>  |    | <b>LAKE KIZAKI</b>                                  | Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen, W83-00345                                      | 2H   | LAKE WESTEINDER  | Phosphate and Wind in a Shallow Lake, W83-00184   |
| Factors Controlling Stable Isotope Composition of European Precipitation, W83-00176   | 2B | <b>LAKE MICHIGAN</b>                                | Association Studies of Polybrominated Biphenyls in Aquatic Systems, W83-00160  | 5B   | LAKES  | Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses, W83-00037                                      |
| <b>ISOTOPE STUDIES</b>  |    | <b>LAKE MORPHOLOGY</b>                              | Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake, W83-00227  | 5C   | LAKE TAHOE   | Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake, W83-00315  |
| Factors Controlling Stable Isotope Composition of European Precipitation, W83-00176   | 2B | <b>LAKE RESTORATION</b>                             | Use of the Water-Salt Balance Method for Calculating the Desalination Regime of a Large Water Body, W83-00322                                    | 5G   | LAKE WESTEINDER  | The Relationship Between Nutrient Status and Chemical Composition of <i>Peridinium cinctum</i> During the Bloom in Lake Kinneret, W83-00333 |
| <b>ISRAEL</b>   |    | <b>LAKE RESTORATION</b>                             | The Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings, W83-00026          | 5C   | LAMBERT-BEER'S LAW   | Components Contributing to Light Extinction in Natural Water: Method of Isolation, W83-00213  |
| The Relationship Between Nutrient Status and Chemical Composition of <i>Peridinium cinctum</i> During the Bloom in Lake Kinneret, W83-00333 | 5C | <b>LAKE SEDIMENTS</b>                               | Lake Restoration Technology Transfer Assessment, W83-00215   | 5G   | LAND DISPOSAL  | The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom, W83-00220                                     |
| <b>JAPAN</b>  |    | <b>LAKE SEDIMENTS</b>                               | An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation, W83-00245   | 5G   | LAND DISPOSAL  | Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential, W83-00233                                     |
| Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments, W83-00018                                     | 5C | <b>LAKE SEDIMENTS</b>                               | Evaluation of Limnological Parameters as Related to the Success of <i>Mysis relicta</i> Introductions, W83-00254                                 | 8I   | LAND DISPOSAL  | Hazardous Waste Technology Transfer Assessment, W83-00276   |
| Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer, W83-00040   | 2H | <b>LAKE SEDIMENTS</b>                               | Stratigraphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery, W83-00329  | 2H   | LAND DISPOSAL  | Spreading Lagooned Sewage Sludge on Farmland: A Case History, W83-00296   |
| Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton, W83-00344  | 2H | <b>LAKE SEDIMENTS</b>                               | Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques, W83-00006                                       | 5C   | LAND DISPOSAL  |   |
| Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen, W83-00345                                 | 2H | <b>LAKE SEDIMENTS</b>                               | Paleoecological Studies of the Recent Development of the Lake Vaxjösjön. IV. Interpretation  |  | LAND DISPOSAL  |   |
| <b>KENTUCKY</b>   |    |   |  |  |  |   |
| Groundwater in the Inner Bluegrass Karst Region, Kentucky, W83-00275  | 2F |   |  |  |  |   |
| <b>KENYA</b>  |    |   |  |  |  |   |
| Irrigation Planning in the Tana Basin of Kenya, W83-00015   | 6B |   |  |  |  |   |
| Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya, W83-00056                                     | 5B |   |  |  |  |   |
| <b>KIELDER DAM</b>  |    |   |  |  |  |   |
| Kielder - Planning to Meet the Future, W83-00207  | 8A |   |  |  |  |   |

## SUBJECT INDEX

### LAND FORMING

**LAND FORMING**  
Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields, W83-00228 5B

**LAND MANAGEMENT**  
Climatic Aspects of Droughts, W83-00188 3F

**LAND RECLAMATION**  
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands, W83-00223 6G

**LAND USE**  
Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia, W83-00128 4A

**HO: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada, W83-00253 6B**

**LANDFILLS**  
Solid Waste Management in South Africa, W83-00090 5G

Multiple Purge Techniques for Determining Organic Pollutants in Groundwater, W83-00158 5A

Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota, W83-00236 5E

**LANDSAT DATA**  
Remote Sensing of Water Resources on Pacific Islands, W83-00262 7C

**LEACHATES**  
Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips, W83-00326 5D

**LEAD**  
Improvements in Foam Flotation for Lead Removal, W83-00150 5D

**LEAKAGE**  
Sewer Maintenance and Rehabilitation, W83-00156 5D

A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation, W83-00205 8G

System Maintenance, W83-00339 8A

**LEGAL ASPECTS**  
The Plight of American Citizens Injured by Transboundary River Pollution, W83-00209 6E

The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands, W83-00223 6G

Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska, W83-00250 6E

Water Law Primer, W83-00318 6E

**LIABILITY**  
The Plight of American Citizens Injured by Transboundary River Pollution, W83-00209 6E

### LIGHT INTENSITY

In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light, W83-00141 5C

### LIGHT PENETRATION

The Development of Attenuation Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake, W83-00055 5C

Components Contributing to Light Extinction in Natural Water: Method of Isolation, W83-00213 5A

### LIME

The Characterization and Processing of Lime Sludges from Water Reclamation Plants, W83-00086 5D

### LIMNOLOGY

Evaluation of Limnological Parameters as Related to the Success of *Mysis relicta* Introductions, W83-00254 8I

### LINEAR PROGRAMMING

Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short- and Long-Term Information in Real Time, W83-00248 4A

### LITERATURE REVIEW

Nutrient Removal From Wastewater by Wetlands, W83-00226 5D

HO: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada, W83-00253 6B

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review, W83-00331 5C

### LITERATURE REVIEWS

Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper, W83-00079 5G

Water Reclamation and Reuse, W83-00163 5D

Pulp and Paper Effluent Management, W83-00164 5D

Law, W83-00165 6E

Water Characteristics, W83-00169 5B

### LITTER

Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona, W83-00301 4D

### LITTORAL ZONE

Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas, W83-00031 2H

Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake, W83-00044 2H

### LIVESTOCK

Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis, W83-00241 6A

Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover), W83-00252 5G

### LOUISIANA

Water Resources Data, Louisiana, Water Year 1981—Volume 2. Southern Louisiana, W83-00057 7C

Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana, W83-00109 4B

### LOW FLOW

Low-Flow Characteristics and Flow Duration of New Jersey Streams, W83-00061 7C

Low Flow of Streams in Fairfax County, Virginia, W83-00062 4C

### LYSIMETERS

A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies, W83-00287 2D

### MACROINVERTEBRATES

Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake, W83-00044 2H

The Ecological Effects of 2-Methylthiotaiazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion, W83-00343 5C

### MAINTENANCE

Sewer Maintenance and Rehabilitation, W83-00156 5D

Control Operations and Maintenance Services, W83-00157 5D

System Maintenance, W83-00339 8A

### MANAGEMENT PLANNING

Policy Objectives and Information System for Irrigation Projects-India, W83-00011 6A

Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I, W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II, W83-00274 10D

### MANGANESE

Softening, Iron and Manganese Removal, W83-00342 5F

### MANGROVE SWAMPS

The Ecology of the Mangroves of South Florida: A Community Profile, W83-00093 6G

### MAPS

Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981, W83-00115 7C

Soil Maps of Montana, W83-00237 7C

### MARSHES

The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh, W83-00266 5G

### MARYLAND

Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data, W83-00058 7C

## SUBJECT INDEX

### MINNESOTA

|  |    |  |    |
|--|----|--|----|
| Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981,<br>W83-00115   | 7C | <b>MATHEMATICAL STUDIES</b>  |    |
| New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,<br>W83-00137                                    | 5G | Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,<br>W83-00005   | 6B |
| Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,<br>W83-00139         | 5B | The Analyses of Areal Rainfall Using Multi-Quadratic Surfaces,<br>W83-00088  | 2B |
| <b>MASSACHUSETTS</b>   |    | Reservoir Management in Potomac River Basin,<br>W83-00203  | 6A |
| Plastics Give 20 Years Life-Span - with Virtually Zero Maintenance.<br>W83-00008                                   | 8G | Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,<br>W83-00282  | 2E |
| <b>MATERIALS ENGINEERING</b>   |    | <b>MAYFLIES</b>  |    |
| Plastics Give 20 Years Life-Span - with Virtually Zero Maintenance.<br>W83-00008                                   | 8G | Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,<br>W83-00030   | 5C |
| <b>MATHEMATICAL EQUATIONS</b>  |    | <b>MEASURING INSTRUMENTS</b>   |    |
| Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,<br>W83-00235       | 3F | A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation,<br>W83-00205  | 8G |
| Instream Salmonid Habitat Exclusion by Ice-Cover,<br>W83-00257   | 8I | <b>MEAT PROCESSING INDUSTRY</b>  |    |
| Pine Tree Evapotranspiration,<br>W83-00279   | 2D | Water and Waste Management in the Canadian Meat and Poultry Processing Industry.<br>W83-00082  | 3E |
| Adjustment of Soil Limitations,<br>W83-00286   | 2G | <b>MECHANICAL EQUIPMENT</b>  |    |
| <b>MATHEMATICAL MODELS</b>   |    | Advanced Treatment.<br>W83-00151   | 5D |
| Estimating Runoff Volumes from Urban Areas,<br>W83-00007   | 4A | Operation Control.<br>W83-00155  | 5G |
| The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,<br>W83-00016   | 6A | Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,<br>W83-00256  | 3A |
| Use of Erosion Models on Western Rangelands,<br>W83-00097  | 2J | <b>MEMBRANE PROCESSES</b>  |    |
| Special Problems in the Application of the USLE to Rangelands: C and P Factors,<br>W83-00100                       | 2J | Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems,<br>W83-00244   | 3A |
| Estimating Sediment Yield from Rangeland with CREAMS,<br>W83-00103   | 2J | Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,<br>W83-00246   | 3A |
| Modeling Erosion in Overland Flow,<br>W83-00104  | 4D | A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,<br>W83-00260   | 3A |
| Predicting Sediment Yields from Sagebrush Rangelands,<br>W83-00106   | 4D | Development of Composite Hollow Fibers - Phase III,<br>W83-00267   | 3A |
| Testing the Modified Universal Soil Loss Equation,<br>W83-00107  | 4D | <b>MEMBRANES</b>   |    |
| Developing a USLE Cover-Management (C) Factor Procedure for Forest Conditions,<br>W83-00108                        | 4D | Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,<br>W83-00246   | 3A |
| Factors Controlling Stable Isotope Composition of European Precipitation,<br>W83-00176                             | 2B | A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,<br>W83-00260   | 3A |
| Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,<br>W83-00218 | 4D | Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities.<br>W83-00261   | 3A |
| The Flow of Slurry from a Breached Tailings Dam,<br>W83-00285  | 8B | <b>MERCURY</b>   |    |
| Persistence in Model Ecosystems,<br>W83-00294  | 5B | Recycling of Mercury and Silver from COD Tests,<br>W83-00145   | 5D |
|  |    | Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,<br>W83-00195  | 5A |
|  |    | <b>MICROBIAL DEGRADATION</b>   |    |
|  |    | Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,<br>W83-00219   | 5B |
|  |    | <b>MICROORGANISMS</b>  |    |
|  |    | Aerobic Degradation of Diuron by Aquatic Microorganisms,<br>W83-00002  | 5B |
|  |    | <b>MIDGES</b>  |    |
|  |    | Paleoecological Studies of the Recent Development of the Lake Vaxjöson. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,<br>W83-00028 | 5C |
|  |    | Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,<br>W83-00031  | 2H |
|  |    | <b>MIDWEST U.S.</b>  |    |
|  |    | Efficient Use of Water for Irrigation in the Upper Midwest,<br>W83-00242   | 3F |
|  |    | <b>MINE WASTES</b>   |    |
|  |    | Water Management in the Oil Shale Industry,<br>W83-00185   | 5D |
|  |    | The Flow of Slurry from a Breached Tailings Dam,<br>W83-00285  | 8B |
|  |    | <b>MINERAL SPRINGS</b>   |    |
|  |    | Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,<br>W83-00112  | 2K |
|  |    | <b>MINERALIZATION</b>  |    |
|  |    | The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands),<br>W83-00178  | 5C |
|  |    | Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,<br>W83-00211   | 5B |
|  |    | <b>MINERALOGY</b>  |    |
|  |    | Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,<br>W83-00124   | 5A |
|  |    | <b>MINING INDUSTRY</b>   |    |
|  |    | Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado,<br>W83-00168  | 4C |
|  |    | <b>MINNESOTA</b>   |    |
|  |    | Designation of Principal Water-Supply Aquifers in Minnesota,<br>W83-00125  | 2F |

## SUBJECT INDEX

### MISSISSIPPI

**MISSISSIPPI**  
Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi, W83-00159 5C

**MISSOURI RIVER BASIN**  
Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin, W83-00121 4D

**MODEL STUDIES**  
Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs, W83-00009 5C

Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes, W83-00025 5C

Use of Rainfall Simulators to Determine Parameters for Erosion Prediction, W83-00102 2J

The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands, W83-00223 6G

Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study, W83-00229 3D

Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems, W83-00244 3A

Incentives for Irrigation Water Conservation in Agriculture, W83-00278 3F

**MONITORING**  
Water Quality of Streams in the Great Smoky Mountains National Park, W83-00032 5B

Plumbline Monitor Interface, W83-00094 8G

Chemical Surveillance of Rivers, W83-00134 5A

Water Quality in Urban Streams—What we can Expect, W83-00144 5C

An Overview of Acid Rain Monitoring Activities in North America, W83-00189 5C

Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme, W83-00196 5A

Intensive Flow Monitoring—Cost-Effectiveness with a Quality Edge, W83-00200 5G

Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents, W83-00204 5A

Practical Techniques of River Monitoring and Pollution Forecasting, W83-00238 5B

Irrigation Scheduling, W83-00310 3F

Design of Monitoring Studies for Priority Pollutants, W83-00321 7A

Metering, Monitoring and Quality Control, W83-00336 8G

Municipal Pretreatment Program Development, W83-00350 5D

**MONTANA**  
Physicochemical Limnology of the Tongue River Reservoir, Montana, W83-00033 2H

Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981, W83-00071 2E

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980, W83-00074 7C

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana, W83-00076 7C

Soil Maps of Montana, W83-00237 7C

**MOUNTAIN LAKES**  
An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation, W83-00245 5G

**MOUNTAINS**  
Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed, W83-00346 2D

Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States, W83-00347 2A

**MT. ST. HELENS**  
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings, W83-00026 5C

Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption, W83-00161 5A

**MULTIVARIATE ANALYSIS**  
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina, W83-00022 5C

**MUNICIPAL WASTES**  
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential, W83-00233 5E

**MUNICIPAL WASTEWATER**  
Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs, W83-00147 5G

**MUNICIPAL WATER**  
The Water Supply of the Brussels Urban Area and its Surroundings, W83-00020 5F

**MUSSELS**  
Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalve Molluscs from Oregon Estuaries, W83-00295 5C

**NAMIBIA**  
A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia, W83-00289 2B

**NASQAN**  
A Study of Trends in Total Phosphorus Measurements at Nasqan Stations, W83-00126 5B

### NATURAL RESOURCES

The Ecology of the Mangroves of South Florida: A Community Profile, W83-00093 6G

### NATURAL STREAMS

Water Quality of Streams in the Great Smoky Mountains National Park, W83-00032 5B

### NAUGATUCK RIVER

Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms, W83-00214 5B

### NEBRASKA

Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing, W83-00111 4D

Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska, W83-00250 6E

### NEUTRALIZATION

An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation, W83-00245 5G

### NEVADA

The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada, W83-00060 4B

Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada, W83-00070 2E

Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada, W83-00253 6B

### NEW ENGLAND REGION

Summary Appraisals of the Nation's Ground-Water Resources—New England Region, W83-00120 4B

### NEW HAMPSHIRE

Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View, W83-00135 5F

Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View, W83-00136 5F

### NEW JERSEY

Low-Flow Characteristics and Flow Duration of New Jersey Streams, W83-00061 7C

### NEW MEXICO

Water-Resources Investigations of the U.S. Geological Survey in New Mexico, Fiscal Year 1980, W83-00073 7A

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico, W83-00078 7C

The USLE Rainfall Factor for Southwestern U.S. Rangelands, W83-00098 4D

Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I, W83-00235 3F

Water Treatment for Small Public Supplies, W83-00280 5F

## SUBJECT INDEX

### OPTIMIZATION

|   |    |  |    |
|---|----|--|----|
| High Plains-Ogallala Aquifer Study, New Mexico - Economic Impacts, W83-00308  | 6B | <b>NORTH AMERICA</b>   |    |
| Water Saving Techniques, W83-00309  | 3F | Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data, W83-00174  | 5B |
| Conservation Through Crops Research, W83-00311  | 3F | An Overview of Acid Rain Monitoring Activities in North America, W83-00189   | 5C |
| <b>NEW YORK</b>   |    | <b>NORTH CAROLINA</b>  |    |
| Effects of the Burrowing Mayfly, <i>Hexagenia</i> , on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms, W83-00030         | 5C | Municipal Point Source and Agricultural Non-point Source Contribution to Coastal Eutrophication, W83-00001   | 5B |
| Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069               | 7C | Manual for Leveling at Gaging Stations in North Carolina, W83-00065  | 7B |
| Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-00116                            | 7C | Water Resources Data for North Carolina, Water Year 1981, W83-00132  | 7C |
| Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York, W83-00117                                    | 7C | Water Quality in Urban Streams--What we can Expect, W83-00144  | 5C |
| Water Resources Data for New York, Water Year 1981--Volume 3. Western New York, W83-00131   | 7C | <b>NORTH DAKOTA</b>  |    |
| <b>NITRATES</b>   |    | Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota, W83-00236   | 5E |
| Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer, W83-00040                                     | 2H | <b>NOVA SCOTIA</b>   |    |
| Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields, W83-00228 | 5B | Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment, W83-00323   | 2K |
| Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral, W83-00300  | 5B | <b>NUISANCE ALGAE</b>  |    |
| Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton, W83-00344                                | 2H | Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques, W83-00006   | 5C |
| <b>NITRIFICATION</b>  |    | <b>NUTRIENT REMOVAL</b>  |    |
| Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer, W83-00040                                     | 2H | Nutrient Removal From Wastewater by Wetlands, W83-00226  | 5D |
| <b>NITROGEN</b>   |    | Advanced Biological Treatment to Achieve Nutrient Removal, W83-00349   | 5D |
| The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh, W83-00266                                    | 5G | <b>NUTRIENT REQUIREMENTS</b>   |    |
| <b>NITROGEN COMPOUNDS</b>   |    | The Relationship Between Nutrient Status and Chemical Composition of <i>Peridinium cinctum</i> During the Bloom in Lake Kinneret, W83-00333                              | 5C |
| Effects of the Burrowing Mayfly, <i>Hexagenia</i> , on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms, W83-00030         | 5C | <b>NUTRIENTS</b>   |    |
| Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen, W83-00345                         | 2H | Physicochemical Limnology of the Tongue River Reservoir, Montana, W83-00033  | 2H |
| <b>NITROGEN REMOVAL</b>   |    | Seasonal Abundance of <i>Ceratium hirundinella</i> , (O.F. Muller) Schrank in Lakes of Different Trophy, W83-00052   | 5C |
| Nutrient Removal From Wastewater by Wetlands, W83-00226   | 5D | Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters, W83-00263   | 5C |
| <b>NONPOINT POLLUTION SOURCES</b>   |    | Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa, W83-00304                                     | 5B |
| Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover), W83-00252                                 | 5G | <b>OBSERVATION WELLS</b>   |    |
|   |    | Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee, W83-00066 | 5B |
|   |    | Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981, W83-00115  | 7C |
|   |    | <b>OCEAN DUMPING</b>   |    |
|   |    | Water Quality Criteria and Effluent Requirements in Broward County, Florida, W83-00320   | 5G |
|   |    | <b>ODOR CONTROL</b>  |    |
|   |    | Disinfection, Odor Prevention and Control, W83-00154   | 5D |
|   |    | Disinfection, Taste and Odor Control, W83-00341  | 5F |
|   |    | <b>OGALLALA AQUIFER</b>  |    |
|   |    | The Ogallala--Half Full or Half Empty, W83-00017   | 6D |
|   |    | High Plains-Ogallala Aquifer Study, New Mexico - Economic Impacts, W83-00308   | 6B |
|   |    | High Plains - Ogallala Aquifer Study Water Transfer Element, W83-00312   | 4A |
|   |    | <b>OHIO</b>  |    |
|   |    | Floodflow Characteristics Related to Channel Geometry in Ohio, W83-00067   | 2E |
|   |    | Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters, W83-00219  | 5B |
|   |    | Stratigraphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery, W83-00329  | 2H |
|   |    | <b>OIL FIELDS</b>  |    |
|   |    | Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters, W83-00127   | 2K |
|   |    | <b>OIL SHALE</b>   |    |
|   |    | Water Management in the Oil Shale Industry, W83-00185  | 5D |
|   |    | <b>OILY WATER</b>  |    |
|   |    | Treatment of Oily Wastewaters from Onshore Operations, W83-00319   | 5D |
|   |    | <b>OKLAHOMA</b>  |    |
|   |    | Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas, W83-00031   | 2H |
|   |    | Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1980 Water Year, W83-00063                               | 4A |
|   |    | Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma, W83-00110         | 7C |
|   |    | <b>OLIGOCHAETES</b>  |    |
|   |    | Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands, W83-00035  | 2L |
|   |    | <b>OLIGOTROPHIC LAKES</b>  |    |
|   |    | Seasonal Abundance of <i>Ceratium hirundinella</i> , (O.F. Muller) Schrank in Lakes of Different Trophy, W83-00052   | 5C |
|   |    | <b>ONTARIO</b>   |    |
|   |    | Seasonal Abundance of <i>Ceratium hirundinella</i> , (O.F. Muller) Schrank in Lakes of Different Trophy, W83-00052   | 5C |
|   |    | <b>OPTIMIZATION</b>  |    |
|   |    | Improvements in Quantifying the Phosphorus Concentration in Lake Water, W83-00208  | 5C |
|   |    | Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time, W83-00248                     | 4A |

## SUBJECT INDEX

### OPTIMUM DEVELOPMENT PLANS

#### OPTIMUM DEVELOPMENT PLANS

Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,  
W83-00240

6B

Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,  
W83-00241

6A

#### OREGON

Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalve Molluscs from Oregon Estuaries,  
W83-00295

5C

#### ORGANIC CARBON

Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System,  
W83-00024

5G

Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,  
W83-00174

5B

#### ORGANIC COMPOUNDS

Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,  
W83-00046

5A

Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,  
W83-00161

5A

Control Measures for Groundwater VOCs,  
W83-00199

5F

Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultra-violet Detection,  
W83-00202

5A

Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,  
W83-00219

5B

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,  
W83-00231

5A

#### ORGANIC LOADING

Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,  
W83-00158

5A

#### ORGANIC MATTER

Removing Soluble Organic Contaminants by Lime-Softening,  
W83-00172

5F

Structural Characterization of Aquatic Humic Material,  
W83-00190

5C

Secondary Treatment.  
W83-00325

5D

#### ORGANIC WASTES

Stabilizing High-Strength Wastes with Photosynthetic Bacteria,  
W83-00181

5D

Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,  
W83-00046

5A

#### ORGANOSULFATES

Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,  
W83-00046

5A

#### ORINOCO RIVER

The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,  
W83-00187

5B

#### OSMOTIC PRESSURE

Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,  
W83-00307

2I

#### OVERLAND FLOW

Modeling Erosion in Overland Flow,  
W83-00104

4D

#### OXIDATION

Biooxidation of Paint Process Wastewater,  
W83-00143

5D

Secondary Treatment.  
W83-00325

5D

#### OXIDATION PROCESS

Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,  
W83-00263

5C

#### OXYGEN TRANSFER

Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,  
W83-0051

5B

#### OXYGENATION

The Use of Oxygen to Upgrade the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,  
W83-00133

5D

#### OYSTERS

Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,  
W83-00159

5C

Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalve Molluscs from Oregon Estuaries,  
W83-00295

5C

#### OZONATION

Disinfection, Odor Prevention and Control.  
W83-00154

5D

#### PACIFIC ISLANDS

Remote Sensing of Water Resources on Pacific Islands,  
W83-00262

7C

#### PAINT INDUSTRY

Biooxidation of Paint Process Wastewater,  
W83-00143

5D

#### PALAU

Remote Sensing of Water Resources on Pacific Islands,  
W83-00262

7C

#### PALEOLIMNOLOGY

Paleoecological Studies of the Recent Development of the Lake Vaxjöson. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,  
W83-00028

5C

The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,  
W83-00042

5C

Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy),  
W83-00316

2H

#### PAPAGO INDIAN RESERVATION

Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,  
W83-00230

3F

#### PARAMETRIC HYDROLOGY

IIHР Distributed Parameter Watershed Model,  
W83-00269

2E

#### PARASITISM

The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,  
W83-00288

5C

#### PARTICLE SIZE

The Characterization and Processing of Lime Sludges from Water Reclamation Plants,  
W83-00086

5D

#### PARTICULATE MATTER

The Development of Attenuation Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake,  
W83-00055

5C

Improvements in Quantifying the Phosphorus Concentration in Lake Water,  
W83-00208

5C

Coliform Attachment to Suspended Particles in Stormwater,  
W83-00224

5B

Cause of Inefficient Solids Separation in the Activated Sludge Process,  
W83-00232

5D

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,  
W83-00345

2H

#### PATH OF POLLUTANTS

Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,  
W83-00068

5B

Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,  
W83-00174

5B

#### PATHOGENIC FUNGI

The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,  
W83-00288

5C

#### PEAK DEMAND

Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,  
W83-00241

6A

#### PENNSYLVANIA

Sludge Disposal from Acid Mine Drainage Treatment,  
W83-00298

5E

#### PERIDIUM

The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,  
W83-00333

5C

#### PERMITS

The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective,  
W83-00210

5G

#### PERSISTENCE

Persistence in Model Ecosystems,  
W83-00294

5B

#### PERSONNEL

Manpower Needs in Wastewater Treatment and Collection Systems for the Years 1980 to 2000,  
W83-00180

5G

#### PERU

Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,  
W83-00037

2H

## SUBJECT INDEX

### POLLUTANT IDENTIFICATION

|  |    |
|--|----|
| <b>PETTAQUAMSCUTT RIVER ESTUARY</b>  |    |
| Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,<br>W83-00263  | 5C |
| <b>PHENOLS</b>   |    |
| The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,<br>W83-00332   | 5B |
| <b>PHOSPHATASE</b>   |    |
| Phytoplankton Contribution to Alkaline Phosphatase Activity,<br>W83-00041  | 2H |
| <b>PHOSPHATASES</b>  |    |
| Induction of High Phosphatase Activity by Aluminum in Acid Lakes,<br>W83-00029   | 5B |
| Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden,<br>W83-00050   | 5C |
| <b>PHOSPHATES</b>  |    |
| Phosphate and Wind in a Shallow Lake,<br>W83-00184   | 5B |
| <b>PHOSPHORUS</b>  |    |
| Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs,<br>W83-00009   | 5C |
| Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,<br>W83-00025   | 5C |
| Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,<br>W83-00046  | 5A |
| A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,<br>W83-00126  | 5B |
| Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs,<br>W83-00147   | 5G |
| Improvements in Quantifying the Phosphorus Concentration in Lake Water,<br>W83-00208   | 5C |
| The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,<br>W83-00266  | 5G |
| <b>PHOSPHORUS REMOVAL</b>  |    |
| Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques,<br>W83-00006  | 5C |
| Nutrient Removal From Wastewater by Wetlands,<br>W83-00226   | 5D |
| Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,<br>W83-00315  | 5G |
| <b>PHOTOSYNTHETIC BACTERIA</b>   |    |
| Stabilizing High-Strength Wastes with Photosynthetic Bacteria,<br>W83-00181  | 5D |
| <b>PHYSICOCHEMICAL PROPERTIES</b>  |    |
| Physicochemical Limnology of the Tongue River Reservoir, Montana,<br>W83-00033   | 2H |
| <b>PHYTOPLANKTON</b>   |    |
| A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina,<br>W83-00022   | 5C |
| Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,<br>W83-00026                                       | 5C |
| Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,<br>W83-00034   | 2H |
| Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,<br>W83-00037  | 2H |
| Diel Periodicity in the Chemical Composition of Lake Phytoplankton,<br>W83-00049   | 5B |
| Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophic,<br>W83-00052   | 5C |
| An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,<br>W83-00053  | 5C |
| The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake,<br>W83-00055 | 5C |
| In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,<br>W83-00141  | 5C |
| Dynamics of Phytoplankton in Finnish Lakes,<br>W83-00153   | 5C |
| The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,<br>W83-00187  | 5B |
| Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,<br>W83-00344  | 2H |
| <b>PINE TREES</b>  |    |
| Pine Tree Evapotranspiration,<br>W83-00279   | 2D |
| <b>PIPELINES</b>   |    |
| Mains and Services,<br>W83-00313   | 8C |
| <b>PIPES</b>   |    |
| Mains and Services,<br>W83-00313   | 8C |
| <b>PLANKTON</b>  |    |
| Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,<br>W83-00315  | 5G |
| <b>PLANNING</b>  |    |
| The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,<br>W83-00016   | 6A |
| Municipal Pretreatment Program Development,<br>W83-00350   | 5D |
| <b>PLANT GROWTH</b>  |    |
| Dendrography for Optimal Water and Energy Utilization in Plant Growth,<br>W83-00265  | 3F |
| <b>PLANT MORPHOLOGY</b>  |    |
| Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,<br>W83-00234   | 3F |
| <b>PLANT PHYSIOLOGY</b>  |    |
| Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,<br>W83-00234   | 3F |
| <b>PLANT WATER POTENTIALS</b>  |    |
| Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,<br>W83-00307  | 21 |
| <b>PLASTICS</b>  |    |
| Plastics Give 20 Years Life-Span - with Virtually Zero Maintenance,<br>W83-00008   | 8G |
| <b>PLUMBLINES</b>  |    |
| Plumbline Monitor Interface,<br>W83-00094  | 8G |
| <b>PLUTONIUM</b>   |    |
| Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant,<br>W83-00019   | 5B |
| <b>POISONS</b>   |    |
| The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,<br>W83-00084  | 2B |
| <b>POLAROGRAPHIC ANALYSIS</b>  |    |
| Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,<br>W83-00045   | 5A |
| <b>POLAROGRAPHY</b>  |    |
| Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,<br>W83-00045   | 5A |
| <b>POLICY MAKING</b>   |    |
| Policy Objectives and Information System for Irrigation Projects-India,<br>W83-00011   | 6A |
| <b>POLLUTANT IDENTIFICATION</b>  |    |
| Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography,<br>W83-00014  | 5A |
| Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,<br>W83-00045   | 5A |
| Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,<br>W83-00046  | 5A |
| Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique),<br>W83-00047   | 5A |
| Chemical Surveillance of Rivers,<br>W83-00134  | 5A |
| Bioassay Technique for Relative Toxicity in Water Pollution Control,<br>W83-00146  | 5A |
| Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,<br>W83-00161                                      | 5A |
| Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,<br>W83-00182   | 5A |

## SUBJECT INDEX

### POLLUTANT IDENTIFICATION

Determination of Iron in Natural Waters and Plant Material with 1,10-Phanthroline by Flow Injection Analysis, W83-00194 5A

Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters, W83-00195 5A

Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultra-violet Detection, W83-00202 5A

Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents, W83-00204 5A

Components Contributing to Light Extinction in Natural Water: Method of Isolation, W83-00213 5A

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy, W83-00231 5A

The Chemical Composition of Water and the Analytical Chemist: A Challenge, W83-00290 5A

Determination of Benzidines in Industrial and Municipal Wastewaters, W83-00292 5A

Design of Monitoring Studies for Priority Pollutants, W83-00321 7A

Preconcentration of Environmental Tin and its Determination Using Catechol Violet, W83-00348 5A

**POLLUTION**  
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential, W83-00233 5E

**POLLUTION LOAD**  
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover), W83-00252 5G

**POLYAROMATIC HYDROCARBONS**  
Adsorption of PAH to Aquatic Humus, W83-00038 5B

**POLYBROMINATED BIPHENYLS**  
Association Studies of Polybrominated Biphenyls in Aquatic Systems, W83-00160 5B

**POLYCYCLIC AROMATIC HYDROCARBONS**  
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water, W83-00330 5B

**POLYNUCLEAR AROMATIC HYDROCARBONS**  
Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalve Molluscs from Oregon Estuaries, W83-00295 5C

**PONAPE ISLAND**  
Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands, W83-00268 8C

**PONDS**  
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina, W83-00022 5C

Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System, W83-00024 5G

### POPLAR TREES

Dendrography for Optimal Water and Energy Utilization in Plant Growth, W83-00265 3F

### POPULATION DYNAMICS

Impact of Chromium to the Population Dynamics of *Tisbe Holothuriae*, W83-00043 5C

Dynamics of Phytoplankton in Finnish Lakes, W83-00153 5C

### POROUS MEDIA

Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation-Part III, W83-00259 3A

### POTENTIOMETRIC LEVEL

Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana, W83-00109 4B

Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981, W83-00115 7C

### POTOMAC RIVER

Reservoir Management in Potomac River Basin, W83-00203 6A

### POULTRY

Water and Waste Management in the Canadian Meat and Poultry Processing Industry, W83-00082 3E

### PRECIPITATION

Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973, W83-00095 7C

Factors Controlling Stable Isotope Composition of European Precipitation, W83-00176 2B

Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes, W83-00282 2E

Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa, W83-00304 5B

Erosion and Sedimentation as Part of the Natural System, W83-00305 2J

### PREDICTION

Instream Salmonid Habitat Exclusion by Ice-Cover, W83-00257 8I

### PRESCRIBED BURNING

Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa, W83-00304 5B

### PRIMARY PRODUCTION

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake, W83-00053 5C

### PRIMARY PRODUCTIVITY

Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers, W83-00051 5B

### PRIMARY WASTEWATER TREATMENT

Primary Treatment, W83-00337 5D

### PROCESS CONTROL

Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes, W83-00149 5D

Control Operations and Maintenance Services, W83-00157 5D

Metering, Monitoring and Quality Control, W83-00336 8G

### PRODUCTIVITY

Limnological Investigations of a Mountain Spring Pond in the Swiss National Park, W83-00034 2H

Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers, W83-00051 5B

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake, W83-00053 5C

### PUBLIC PARTICIPATION

A Cooperative Water Resource Technology Transfer Program, W83-00216 6B

### PUBLIC RELATIONS

Spreading Lagooned Sewage Sludge on Farmland: A Case History, W83-00296 5E

### PUERTO RICO

Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites, W83-00072 5B

### PULP AND PAPER INDUSTRY

Pulp and Paper Effluent Management, W83-00164 5D

### PUMPS

Large Water Transport Pumps, W83-00206 8C

### PYRAZON

Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography, W83-00014 5A

### QUALITY CONTROL

Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme, W83-00196 5A

### RADIOACTIVE WASTE DISPOSAL

Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant, W83-00019 5B

### RADIOACTIVE WASTES

Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout (*Salmo Gairdneri*), W83-00021 5C

### RAIN

Role of Fungi in Postfire Stabilization of Chaparral Ash Beds, W83-00302 4D

### RAINFALL

The USLE Rainfall Factor for Southwestern U. S. Rangelands, W83-00098 4D

## SUBJECT INDEX

### REVIEWS

|  |    |  |
|--|----|--|
| <b>RAINFALL INTENSITY</b>  |    |  |
| The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation, W83-00140                             | 2J |  |
| <b>RAINFALL INTENSITY</b>  |    |  |
| The USLE Rainfall Factor for Southwestern U. S. Rangelands, W83-00098  | 4D |  |
| A Test of the USLE on Bare and Sagebrush Plots in Utah, W83-00101  | 4D |  |
| <b>RAINFALL RATE</b>   |    |  |
| Effects of Slope Length and Steepness on Soil Erosion from Rangelands, W83-00099   | 2J |  |
| <b>RAINFALL-RUNOFF RELATIONSHIPS</b>   |    |  |
| Estimating Runoff Volumes from Urban Areas, W83-00007  | 4A |  |
| Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado, W83-00077  | 7C |  |
| Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study, W83-00083   | 5D |  |
| Modeling Erosion in Overland Flow, W83-00104   | 4D |  |
| Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation, W83-00230   | 3F |  |
| <b>RAINFALL SIMULATORS</b>   |    |  |
| Use of Rainfall Simulators to Determine Parameters for Erosion Prediction, W83-00102   | 2J |  |
| <b>RANGE MANAGEMENT</b>  |    |  |
| Special Problems in the Application of the USLE to Rangelands: C and P Factors, W83-00100  | 2J |  |
| <b>RANGELAND</b>   |    |  |
| Relation of USLE Factors to Erosion on Rangeland, W83-00096  | 2J |  |
| Use of Erosion Models on Western Rangelands, W83-00097   | 2J |  |
| The USLE Rainfall Factor for Southwestern U. S. Rangelands, W83-00098  | 4D |  |
| Effects of Slope Length and Steepness on Soil Erosion from Rangelands, W83-00099   | 2J |  |
| Predicting Sediment Yields from Sagebrush Rangelands, W83-00106  | 4D |  |
| <b>RANGELANDS</b>  |    |  |
| Special Problems in the Application of the USLE to Rangelands: C and P Factors, W83-00100  | 2J |  |
| A Test of the USLE on Bare and Sagebrush Plots in Utah, W83-00101  | 4D |  |
| Estimating Sediment Yield from Rangeland with CREAMS, W83-00103  | 2J |  |
| <b>RECLAIMED WATER</b>   |    |  |
| Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage, W83-00023   | 5G |  |
| <b>The Characterization and Processing of Lime Sludges from Water Reclamation Plants, W83-00086</b>  | 5D |  |
| <b>Water Reclamation and Reuse, W83-00163</b>  | 5D |  |
| Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation—Part III, W83-00259                                   | 3A |  |
| <b>RECREATION</b>  |    |  |
| Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada, W83-00070                           | 2E |  |
| <b>RECYCLING</b>   |    |  |
| Recycling of Mercury and Silver from COD Tests, W83-00145  | 5D |  |
| <b>REESE RIVER</b>   |    |  |
| Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada, W83-00253  | 6B |  |
| <b>REGIONAL ANALYSIS</b>   |    |  |
| Summary Appraisals of the Nation's Ground-Water Resources—New England Region, W83-00120  | 4B |  |
| <b>REGIONAL PLANNING</b>   |    |  |
| Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240   | 6B |  |
| <b>REGULATIONS</b>   |    |  |
| Water Quality Standards and Water Quality, W83-00162   | 5G |  |
| Law, W83-00165   | 6E |  |
| <b>REMOTE SENSING</b>  |    |  |
| Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation, W83-00230   | 3F |  |
| Remote Sensing of Water Resources on Pacific Islands, W83-00262  | 7C |  |
| <b>RESEARCH PRIORITIES</b>   |    |  |
| Conservation Through Crops Research, W83-00311   | 3F |  |
| <b>RESERVOIR CONSTRUCTION</b>  |    |  |
| Kielder - Planning to Meet the Future, W83-00207   | 8A |  |
| <b>RESERVOIR DESIGN</b>  |    |  |
| Kielder - Planning to Meet the Future, W83-00207   | 8A |  |
| <b>RESERVOIR OPERATION</b>   |    |  |
| Reservoir Management in Potomac River Basin, W83-00203   | 6A |  |
| Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time, W83-00248 | 4A |  |
| Water Quality Simulation of Wahiawa Reservoir, O'ahu, Hawaii, W83-00281  | 5G |  |
| <b>RESERVOIR STORAGE</b>   |    |  |
| Blackheath Water Treatment Plant, W83-00283  | 5F |  |
| <b>RESERVOIRS</b>  |    |  |
| Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs, W83-00009  | 5C |  |
| Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas, W83-00031   | 2H |  |
| Physicochemical Limnology of the Tongue River Reservoir, Montana, W83-00033  | 2H |  |
| Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time, W83-00248 | 4A |  |
| Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover, W83-00255                                 | 8I |  |
| Water Storage, W83-00340   | 8C |  |
| <b>RESINS</b>  |    |  |
| Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities, W83-00261                                      | 3A |  |
| <b>RESOURCES DEVELOPMENT</b>   |    |  |
| Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada, W83-00253  | 6B |  |
| <b>RESOURCES MANAGEMENT</b>  |    |  |
| High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts, W83-00308  | 6B |  |
| <b>REVERSE OSMOSIS</b>   |    |  |
| Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems, W83-00244  | 3A |  |
| Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates, W83-00246  | 3A |  |
| Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device, W83-00256   | 3A |  |
| A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin, W83-00260                  | 3A |  |
| Development of Composite Hollow Fibers - Phase III, W83-00267  | 3A |  |
| Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis, W83-00270  | 3A |  |
| Water Treatment for Small Public Supplies, W83-00280   | 5F |  |
| <b>REVIEWS</b>   |    |  |
| Water Reclamation and Reuse, W83-00163   | 5D |  |
| Pulp and Paper Effluent Management, W83-00164  | 5D |  |
| Law, W83-00165   | 6E |  |
| Water Characteristics, W83-00169   | 5B |  |
| An Overview of Acid Rain Monitoring Activities in North America, W83-00189   | 5C |  |

## SUBJECT INDEX

### REVIEWS

|  |    |  |    |   |    |
|--|----|--|----|---|----|
| <b>HO: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada, W83-00253</b>   | 6B | <b>SALINE WATER</b><br>Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222                           | 3A | <b>SECONDARY WASTEWATER TREATMENT</b><br>High-Quality Trickling Filter Effluent Without Tertiary Treatment, W83-00142   | 5D |
| <b>RHODE ISLAND</b><br>Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters, W83-00263  | 5C | <b>SALINE WATER INTRUSION</b><br>Revaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake, W83-00227  | 5C | Secondary Treatment, W83-00325  | 5D |
| <b>RIVER BASINS</b><br>Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980, W83-00113  | 7C | <b>SALINITY</b><br>Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas, W83-00031  | 2H | <b>SEDIMENT LOAD</b><br>Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa, W83-00304                          | 5B |
| <b>RIVERS</b><br>Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing, W83-00111                                  | 4D | <b>SALT</b><br>Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts, W83-00139   | 5B | <b>SEDIMENT-WATER INTERACTIONS</b><br>Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms, W83-00214  | 5B |
| Chemical Surveillance of Rivers, W83-00134   | 5A | <b>SALT BALANCE</b><br>Use of the Water-Salt Balance Method for Calculating the Desalination Regime of a Large Water Body, W83-00322                           | 5G | <b>SEDIMENT YIELD</b><br>Estimating Sediment Yield from Rangeland with CREAMS, W83-00103  | 2J |
| Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data, W83-00174  | 5B | <b>SALT REJECTION</b><br>Development of Composite Hollow Fibers - Phase III, W83-00267   | 3A | Predicting Sediment Yields from Sagebrush Rangelands, W83-00106   | 4D |
| <b>ROAD CONSTRUCTION</b><br>The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment, W83-00042   | 5C | <b>SAMPLE PREPARATION</b><br>Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters, W83-00195            | 5A | <b>SEDIMENTARY STRUCTURES</b><br>Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing, W83-00111 | 4D |
| <b>ROTIFERS</b><br>Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage, W83-00023  | 5G | <b>SAMPLING</b><br>Chemical Surveillance of Rivers, W83-00134  | 5A | <b>SEDIMENTATION</b><br>Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona, W83-00301                                     | 4D |
| <b>RUNOFF</b><br>Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973, W83-00095  | 7C | Improvements in Quantifying the Phosphorus Concentration in Lake Water, W83-00208  | 5C | Estimating Hydrologic Values for Planning Wildland Fire Protection, W83-00306   | 6B |
| Relation of USLE Factors to Erosion on Rangeland, W83-00096  | 2J | <b>SCALING</b><br>Chemical Stability of Water, W83-00091   | 5F | Water Supply and Treatment, Section C-1, Raw Water Preparation, W83-00335   | 5F |
| Effects of Slope Length and Steepness on Soil Erosion from Rangelands, W83-00099   | 2J | Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222  | 3A | Primary Treatment, W83-00337  | 5D |
| <b>RUNOFF RATES</b><br>Testing the Modified Universal Soil Loss Equation, W83-00107  | 4D | <b>SCOTLAND</b><br>Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme, W83-00196 | 5A | <b>SEDIMENTATION RATES</b><br>Erosion and Sedimentation as Part of the Natural System, W83-00305  | 2J |
| <b>RUNOFF VOLUME</b><br>Estimating Runoff Volumes from Urban Areas, W83-00007  | 4A | <b>SCREENS</b><br>Water Supply and Treatment, Section C-1, Raw Water Preparation, W83-00335  | 5F | <b>SEDIMENTS</b><br>Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands, W83-00035   | 2L |
| Testing the Modified Universal Soil Loss Equation, W83-00107   | 4D | Primary Treatment, W83-00337   | 5D | Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin, W83-00121  | 4D |
| <b>RURAL AREAS</b><br>Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis, W83-00241   | 6A | <b>SEASONAL VARIATION</b><br>Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India, W83-00027  | 2H | Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi, W83-00159  | 5C |
| Wastewater Management Problems in Rural Communities, W83-00249   | 5G | Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya, W83-00056  | 5B | Association Studies of Polybrominated Biphenyls in Aquatic Systems, W83-00160   | 5B |
| <b>SAGEBRUSH</b><br>Predicting Sediment Yields from Sagebrush Rangelands, W83-00106  | 4D | Pine Tree Evapotranspiration, W83-00279  | 2D | <b>SELF-PURIFICATION</b><br>Some Aspects of the Colonization by Water Mites (Acar, Actinedida) of an Artificial Substrate in a Disturbed Environment, W83-00054                       | 5C |
| <b>SALINE-FRESHWATER INTERFACES</b><br>Estimated Effects of Projected Ground-Water With-Drawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida, W83-00130 | 4B | <b>SEAWATER</b><br>Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis, W83-00270   | 3A | <b>SEPTIC TANKS</b><br>Daily Chemical Variability of Domestic Septic Tank Effluent, W83-00328   | 5D |
|  |    |  |    | <b>SEWER SYSTEMS</b><br>Sewer Maintenance and Rehabilitation, W83-00156   | 5D |

## SUBJECT INDEX

### SOIL STABILIZATION

|  |    |  |    |
|--|----|--|----|
| Intensive Flow Monitoring--Cost-Effectiveness with a Quality Edge,<br>W83-00200  | 5G | Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,<br>W83-00233               | 5E |
| Collection Systems.<br>W83-00338   | 8C | High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,<br>W83-00243            | 5D |
| <b>SEX REVERSAL (FISH)</b>   |    | Spreading Lagooned Sewage Sludge on Farm-land: A Case History,<br>W83-00296  | 5E |
| Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II,<br>W83-00272             | 4A | Sludge Disposal from Acid Mine Drainage Treatment,<br>W83-00298  | 5E |
| <b>SHIELD LAKES</b>  |    | <b>SLUDGE DRYING</b>   |    |
| The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,<br>W83-00042                            | 5C | The Characterization and Processing of Lime Sludges from Water Reclamation Plants,<br>W83-00086                          | 5D |
| <b>SHRIMP</b>  |    | <b>SLUDGE THICKENING</b>   |    |
| Evaluation of Limnological Parameters as Related to the Success of <i>Mysis Relicta</i> Introductions,<br>W83-00254          | 8I | Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,<br>W83-00179                     | 5D |
| <b>SIDESTREAMS</b>   |    | <b>SMALL WATERSHEDS</b>  |    |
| Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,<br>W83-00291                              | 5D | Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,<br>W83-00071                         | 2E |
| <b>SILVER</b>  |    | Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,<br>W83-00124 | 5A |
| Recycling of Mercury and Silver from COD Tests,<br>W83-00145   | 5D | Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,<br>W83-00128         | 4A |
| <b>SILVER IODIDE</b>   |    | <b>SMOKY MOUNTAINS</b>   |    |
| The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,<br>W83-00084                                | 2B | Water Quality of Streams in the Great Smoky Mountains National Park,<br>W83-00032  | 5B |
| <b>SIMULATION ANALYSIS</b>   |    | <b>SNOWMELT</b>  |    |
| Water Quality Simulation of Wahiaawa Reservoir, O'Ahu, Hawaii,<br>W83-00281  | 5G | Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,<br>W83-00227                                   | 5C |
| <b>SITE SELECTION</b>  |    | <b>SOCIAL IMPACT</b>   |    |
| Use of Fracture Traces in Water Well Location: a Handbook.<br>W83-00217  | 4B | Environmental Impact of Large Hydroelectric Projects on Tropical Countries,<br>W83-00010                                 | 6G |
| Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,<br>W83-00236                              | 5E | Irrigation Planning in the Tana Basin of Kenya,<br>W83-00015   | 6B |
| <b>SLOPES</b>  |    | <b>SODIUM</b>  |    |
| Effects of Slope Length and Steepness on Soil Erosion from Rangelands,<br>W83-00099  | 2J | New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,<br>W83-00137  | 5G |
| Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,<br>W83-00301 | 4D | Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,<br>W83-00139               | 5B |
| <b>SLUDGE</b>  |    | <b>SOIL CHARACTERISTICS</b>  |    |
| The Characterization and Processing of Lime Sludges from Water Reclamation Plants,<br>W83-00086                              | 5D | Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,<br>W83-00236                          | 5E |
| High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,<br>W83-00243                | 5D | <b>SOIL CLASSIFICATION</b>   |    |
| <b>SLUDGE DIGESTION</b>  |    | Soil Survey of the Experimental Catchments Near Bethlehem,<br>W83-00087  | 4D |
| A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters,<br>W83-00138                                    | 5D | Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,<br>W83-00218       | 4D |
| Sludge Digestion and Disposal.<br>W83-00152  | 5D | <b>SOIL PROPERTIES</b>   |    |
| Digester Control Pays Dividends,<br>W83-00192  | 5D | Adjustment of Soil Limitations,<br>W83-00286   | 2G |
| <b>SLUDGE DISPOSAL</b>   |    | <b>SOIL STABILIZATION</b>  |    |
| Sludge Digestion and Disposal.<br>W83-00152  | 5D | Adjustment of Soil Limitations,<br>W83-00286   | 2G |

## SUBJECT INDEX

### SOIL SURVEYS

**SOIL SURVEYS**  
 Soil Survey of the Experimental Catchments Near Bethlehem, W83-00087 4D

Soil Maps of Montana, W83-00237 7C

### SOIL TREATMENT

Adjustment of Soil Limitations, W83-00286 2G

### SOIL WATER

Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land, W83-00264 5B

### SOIL-WATER-PLANT RELATIONSHIPS

Adjustment of Soil Limitations, W83-00286 2G

### SOLID WASTE DISPOSAL

Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites, W83-00072 5B

### SOLID WASTES

Solid Waste Management in South Africa, W83-00090 5G

### SOLID CONTACT PROCESSES

High-Quality Trickling Filter Effluent Without Tertiary Treatment, W83-00142 5D

### SOLUTES

Removing Soluble Organic Contaminants by Lime-Softening, W83-00172 5F

### SOLVENTS

Biooxidation of Paint Process Wastewater, W83-00143 5D

### SOUTH AFRICA

Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes, W83-00025 5C

The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance, W83-00036 2H

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake, W83-00053 5C

Hydrology and Water Resources of the Drakensberg, W83-00085 4A

Soil Survey of the Experimental Catchments Near Bethlehem, W83-00087 4D

The Statistics of Extreme Values and the Analysis of Floods in South Africa, W83-00089 2E

Solid Waste Management in South Africa, W83-00090 5G

The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation, W83-00140 2J

Blackheath Water Treatment Plant, W83-00283 5F

Adjustment of Soil Limitations, W83-00286 2G

A Weighing Lysimeter Facility at Roodplaats for Crop Evapotranspiration Studies, W83-00287 2D

Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa, W83-00304 5B

**SOUTHWESTERN KANSAS**  
 Geohydrology of Southwestern Kansas, W83-00059 7C

### SOYBEANS

Dendrography for Optimal Water and Energy Utilization in Plant Growth, W83-00265 3F

### SPECIES COMPOSITION

The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance, W83-00036 2H

Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya, W83-00056 5B

Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy), W83-00316 2H

### SPECIES DIVERSITY

Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage, W83-00023 5G

### SPECTRAL ANALYSIS

Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System, W83-00024 5G

### SPECTROPHOTOMETRY

Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique), W83-00047 5A

Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis, W83-00194 5A

Preconcentration of Environmental Tin and its Determination Using Catechol Violet, W83-00348 5A

### SPECTROSCOPY

Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters, W83-00195 5A

The Chemical Composition of Water and the Analytical Chemist: A Challenge, W83-00290 5A

### SPIRIT LAKE

Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings, W83-00026 5C

### SPRINKLER IRRIGATION

Water Saving Techniques, W83-00309 3F

### ST. LOUIS BAY

Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi, W83-00159 5C

### STABILIZATION PONDS

Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation, W83-00284 5D

### STABLE ISOTOPES

Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington, W83-00112 2K

### STOCHASTIC HYDROLOGY

Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time, W83-00248 4A

### STANDARDS

Solid Waste Management in South Africa, W83-00090 5G

### STANDING CROPS

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake, W83-00053 5C

### STANDPIPES

Water Storage, W83-00340 8C

### STATISTICAL ANALYSIS

Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia, W83-00112 4A

Wastewater Management Problems in Rural Communities, W83-00249 5G

Dendrography for Optimal Water and Energy Utilization in Plant Growth, W83-00265 3F

### STATISTICAL METHODS

The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation, W83-00016 6A

Hydrology and Water Resources of the Drakensberg, W83-00085 4A

The Statistics of Extreme Values and the Analysis of Floods in South Africa, W83-00089 2E

A Study of Trends in Total Phosphorus Measurements at Nasqan Stations, W83-00126 5B

### STOCHASTIC PROCESS

Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes, W83-00282 2E

### STOMATAL TRANSPIRATION

Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral, W83-00307 2I

### STORAGE TANKS

Water Storage, W83-00340 8C

### STORM RUNOFF

Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado, W83-00077 7C

Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study, W83-00083 5D

## SUBJECT INDEX

## TECHNOLOGY TRANSFER

|   |    |  |    |  |    |
|---|----|--|----|--|----|
| <b>STORM SEWERS</b><br>Drainage and Structures.<br>W83-00334  | 8A | Summary Appraisals of the Nation's Ground-Water Resources—New England Region,<br>W83-00120   | 4B | <b>SURVEYS</b><br>Hazardous Waste Technology Transfer Assessment,<br>W83-00276   | 5E |
| <b>STORM WASTEWATER</b><br>Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,<br>W83-00083                                    | 5D | <b>SUBMERGED PLANTS</b><br>The Ecological Effects of 2-Methylthiotaiazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,<br>W83-00343 | 5C | <b>SUSPENDED SOLIDS</b><br>Components Contributing to Light Extinction in Natural Water: Method of Isolation,<br>W83-00213   | 5A |
| <b>STORM WATER</b><br>Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,<br>W83-00083   | 5D | <b>SUCCESSION</b><br>Dynamics of Phytoplankton in Finnish Lakes,<br>W83-00153  | 5C | Coliform Attachment to Suspended Particles in Stormwater,<br>W83-00224   | 5B |
| Management and Control Technology for Urban Stormwater Pollution,<br>W83-00148  | 5G | <b>SULFUR</b><br>Determination of Organophosphorus and Organosulfur at the Sub-NG-Level for Use in Water Analysis,<br>W83-00046  | 5A | Cause of Inefficient Solids Separation in the Activated Sludge Process,<br>W83-00232   | 5D |
| <b>STORMWATER</b><br>Coliform Attachment to Suspended Particles in Stormwater,<br>W83-00224   | 5B | <b>SULFUR COMPOUNDS</b><br>Effects of the Burrowing Mayfly, <i>Hexagenia</i> , on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,<br>W83-00030  | 5C | Secondary Treatment.<br>W83-00325  | 5D |
| <b>STRAIN GAGES</b><br>Dendrography for Optimal Water and Energy Utilization in Plant Growth,<br>W83-00265                                    | 3F | <b>SURFACE-GROUNDWATER RELATIONS</b><br>An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979,<br>W83-00064   | 5B | Water Supply and Treatment, Section C-1, Raw Water Preparation.<br>W83-00335   | 5F |
| <b>STREAM DISCHARGE</b><br>Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,<br>W83-00123                        | 4A | <b>SURFACE RUNOFF</b><br>Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,<br>W83-00301  | 4D | Primary Treatment.<br>W83-00337  | 5D |
| <b>STREAM GAGES</b><br>Manual for Leveling at Gaging Stations in North Carolina,<br>W83-00065   | 7B | <b>SURFACE WATER</b><br>Water Resources Data, Louisiana, Water Year 1981—Volume 2. Southern Louisiana.<br>W83-00057  | 7C | <b>SWEDEN</b><br>Paleoecological Studies of the Recent Development of the Lake Vaxjösjön. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,<br>W83-00028 | 5C |
| <b>STREAM POLLUTION</b><br>Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),<br>W83-00252             | 5G | <b>SWITZERLAND</b><br>Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,<br>W83-00034   | 2H |  |    |
| <b>STREAMFLOW</b><br>Low-Flow Characteristics and Flow Duration of New Jersey Streams,<br>W83-00061   | 7C | <b>SYNTHESIS</b><br>Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation—Part III,<br>W83-00259  | 3A |  |    |
| Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas—Oklahoma, 1980 Water Year,<br>W83-00063 | 4A | A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,<br>W83-00260   | 3A |  |    |
| Floodflow Characteristics Related to Channel Geometry in Ohio,<br>W83-00067   | 2E | <b>SYSTEMS ANALYSIS</b><br>Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,<br>W83-00241   | 6A |  |    |
| Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin,<br>W83-00121                           | 4D | <b>TASTE</b><br>Disinfection, Taste and Odor Control.<br>W83-00341   | 5F |  |    |
| Streamflows and Channels of the Green River Basin, Wyoming,<br>W83-00122  | 4A | <b>TAXES</b><br>Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,<br>W83-00005   | 6B |  |    |
| Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,<br>W83-00123   | 4A | <b>TECHNOLOGY TRANSFER</b><br>Lake Restoration Technology Transfer Assessment,<br>W83-00215  | 5G |  |    |
| Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,<br>W83-00251   | 2E | A Cooperative Water Resource Technology Transfer Program,<br>W83-00216   | 6B |  |    |
| Water Yield Changes Resulting from Treatment of Arizona Chaparral,<br>W83-00303   | 3B | A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,<br>W83-00247   | 5G |  |    |
| <b>STREAMS</b><br>Low Flow of Streams in Fairfax County, Virginia,<br>W83-00062   | 4C |  |    |  |    |
| Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,<br>W83-00072   | 5B |  |    |  |    |

## SUBJECT INDEX

### TECHNOLOGY TRANSFER

|  |    |  |    |  |    |
|--|----|--|----|--|----|
| Hazardous Waste Technology Transfer Assessment,<br>W83-00276   | 5E | Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters,<br>W83-00127  | 2K | TRICKLE IRRIGATION<br>Water Saving Techniques,<br>W83-00309  | 3F |
| <b>TEMPORAL DISTRIBUTION</b><br>Climatic Aspects of Droughts,<br>W83-00188   | 3F | <b>THERORETICAL ANALYSIS</b><br>The Analyses of Areal Rainfall Using Multi-Quadric Surfaces,<br>W83-00088  | 2B | <b>TRICKLING FILTERS</b><br>High-Quality Trickling Filter Effluent Without Tertiary Treatment,<br>W83-00142  | 5D |
| <b>TENNESSEE</b><br>Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee,<br>W83-00066                | 5B | <b>THIN FILMS</b><br>Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,<br>W83-00246                        | 3A | Fixed-Film Biological Processes,<br>W83-00191  | 5D |
| <b>TERBUTRYNE</b><br>The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,<br>W83-00343 | 5C | A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,<br>W83-00260           | 3A | <b>TROPICAL REGIONS</b><br>The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,<br>W83-00187                               | 5B |
| <b>TERRAIN ANALYSIS</b><br>The Analyses of Areal Rainfall Using Multi-Quadric Surfaces,<br>W83-00088   | 2B | <b>THORIUM</b><br>Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout ( <i>Salmo Gairdneri</i> ),<br>W83-00021 | 5C | Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,<br>W83-00268  | 8C |
| <b>TERTIAL WASTEWATER TREATMENT</b><br>Advanced Treatment,<br>W83-00151  | 5D | <b>THUNDERSTORMS</b><br>The USLE Rainfall Factor for Southwestern U. S. Rangelands,<br>W83-00098   | 4D | <b>TROUT</b><br>Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout ( <i>Salmo Gairdneri</i> ),<br>W83-00021     | 5C |
| <b>TESTING PROCEDURES</b><br>Simple Control Tests for Operators of Small Wastewater Treatment Plants,<br>W83-00092   | 5D | <b>TILE DRAINAGE</b><br>Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,<br>W83-00264               | 5B | <b>TUG FORK BASIN</b><br>Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,<br>W83-00128          | 4A |
| <b>TEXAS</b><br>The Ogallala--Half Full or Half Empty.,<br>W83-00017   | 6D | <b>TIN</b><br>Preconcentration of Environmental Tin and its Determination Using Catechol Violet,<br>W83-00348                                    | 5A | <b>TURBULENT FLOW</b><br>Phosphate and Wind in a Shallow Lake,<br>W83-00184  | 5B |
| Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,<br>W83-00031  | 2H | <b>TISBE HOLOTHURIAE</b><br>Impact of Chromium to the Population Dynamics of <i>Tisbe Holothuriae</i> ,<br>W83-00043                             | 5C | <b>ULTRAFILTRATION</b><br>Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,<br>W83-00259   | 3A |
| Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,<br>W83-00075                    | 7C | <b>TOPOGRAPHIC MAPPING</b><br>Soil Maps of Montana,<br>W83-00237   | 7C | <b>ULTRASONICS</b><br>Non-Contacting Ultrasonic for Flow and Level Control,<br>W83-00221   | 5D |
| <b>TEXTILE MILL WASTES</b><br>Textile Industry Wastewater Treatment by Air Flotation,<br>W83-00080   | 5D | <b>TOXICITY</b><br>Impact of Chromium to the Population Dynamics of <i>Tisbe Holothuriae</i> ,<br>W83-00043                                      | 5C | <b>UNITED KINGDOM</b><br>Chemical Surveillance of Rivers,<br>W83-00134   | 5A |
| <b>THE NETHERLANDS</b><br>Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands,<br>W83-00035   | 2L | Bioassay Technique for Relative Toxicity in Water Pollution Control,<br>W83-00146  | 5A | Kielder - Planning to Meet the Future.<br>W83-00207  | 8A |
| Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands,<br>W83-00039   | 5B | The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,<br>W83-00332   | 5B | The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,<br>W83-00220   | 5E |
| The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands),<br>W83-00178  | 5C | <b>TOXINS</b><br>Adsorption of Toxic and Carcinogenic Compounds from Water,<br>W83-00171   | 5F | <b>URANIUM</b><br>Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout ( <i>Salmo Gairdneri</i> ),<br>W83-00021   | 5C |
| Phosphate and Wind in a Shallow Lake,<br>W83-00184   | 5B | <b>TRAINING</b><br>Manual for Leveling at Gaging Stations in North Carolina,<br>W83-00065  | 7B | <b>URBAN DRAINAGE</b><br>Estimating Runoff Volumes from Urban Areas,<br>W83-00007  | 4A |
| <b>THEORETICAL ANALYSIS</b><br>The Statistics of Extreme Values and the Analyses of Floods in South Africa,<br>W83-00089   | 2E | <b>TRANSPERSION</b><br>Water Yield Changes Resulting from Treatment of Arizona Chaparral,<br>W83-00303   | 3B | Adaptation of the ILLUDAS Model to a Desktop Computer,<br>W83-00081  | 7B |
| <b>TERMAL SPRINGS</b><br>Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,<br>W83-00112   | 2K | <b>TREATED WATER</b><br>Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,<br>W83-00330  | 5B | <b>URBAN PLANNING</b><br>Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,<br>W83-00229 | 3D |
| <b>TERMAL WATER</b><br>The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada,<br>W83-00060   | 4B | <b>TREATMENT FACILITIES</b><br>Sludge Disposal from Acid Mine Drainage Treatment,<br>W83-00298   | 5E | <b>URBAN RUNOFF</b><br>Adaptation of the ILLUDAS Model to a Desktop Computer,<br>W83-00081   | 7B |
|  |    |  |    | Management and Control Technology for Urban Stormwater Pollution,<br>W83-00148   | 5G |

## SUBJECT INDEX

### WASTEWATER TREATMENT

|  |    |            |   |    |                              |    |
|--|----|------------|---|----|------------------------------|----|
| Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake, W83-00227  | 5C | WALES      | Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme, W83-00196                 | 5A | <b>WASTEWATER FACILITIES</b> |    |
| URBAN WATERSHEDS   |    | WASHINGTON | Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings, W83-00026                         | 5C | Operation Control, W83-00155 | 5G |
| Water Quality in Urban Streams--What we can Expect, W83-00144  | 5C |            | Control Operations and Maintenance Services, W83-00157  | 5D |                              |    |
| URBANIZATION   |    |            | Cause of Inefficient Solids Separation in the Activated Sludge Process, W83-00232   | 5D |                              |    |
| Low Flow of Streams in Fairfax County, Virginia, W83-00062   | 4C |            | The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation, W83-00258   | 5G |                              |    |
| USER CHARGES   |    |            | <b>WASTEWATER FARMING</b>   |    |                              |    |
| Metering, Monitoring and Quality Control, W83-00336  | 8G |            | Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation, W83-00230  | 3F |                              |    |
| UTAH   |    |            | <b>WASTEWATER MANAGEMENT</b>  |    |                              |    |
| A Test of the USLE on Bare and Sagebrush Plots in Utah, W83-00101  | 4D |            | Trade Effluent Control and the Microprocessor, W83-00003  | 5G |                              |    |
| Final Environmental Impact Statement of the White River Dam Project, W83-00297   | 6G |            | Nutrient Removal From Wastewater by Wetlands, W83-00226   | 5D |                              |    |
| VASCULAR TISSUES   |    |            | A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management, W83-00247   | 5G |                              |    |
| Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers, W83-00051                             | 5B |            | Wastewater Management Problems in Rural Communities, W83-00249  | 5G |                              |    |
| VENEZUELA  |    |            | <b>WASTEWATER POLLUTION</b>   |    |                              |    |
| The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela, W83-00187   | 5B |            | Some Aspects of the Colonization by Water Mites (Acar, Actinedida) of an Artificial Substrate in a Disturbed Environment, W83-00054                         | 5C |                              |    |
| VERMONT  |    |            | <b>WASTEWATER RENOVATION</b>  |    |                              |    |
| Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States, W83-00347  | 2A |            | Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage, W83-00023  | 5G |                              |    |
| VERTICAL DISTRIBUTION  |    |            | The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation, W83-00258   | 5G |                              |    |
| The Development of Attenuation Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake, W83-00055 | 5C |            | The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh, W83-00266  | 5G |                              |    |
| VIBRIO   |    |            | Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems, W83-00324  | 5G |                              |    |
| The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England, W83-00012   | 5B |            | <b>WASTEWATER TREATMENT</b>   |    |                              |    |
| VIRGINIA   |    |            | Textile Industry Wastewater Treatment by Air Flotation, W83-00080   | 5D |                              |    |
| Low Flow of Streams in Fairfax County, Virginia, W83-00062   | 4C |            | Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study, W83-00083  | 5D |                              |    |
| VOLATILE ACIDS   |    |            | Simple Control Tests for Operators of Small Wastewater Treatment Plants, W83-00092  | 5D |                              |    |
| Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips, W83-00326  | 5D |            | The Use of Oxygen to Upgrade the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works, W83-00133 | 5D |                              |    |
| VOLATILE ORGANIC COMPOUNDS   |    |            | A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters, W83-00138  | 5D |                              |    |
| Control Measures for Groundwater VOCs, W83-00199   | 5F |            | Biooxidation of Paint Process Wastewater, W83-00143   | 5D |                              |    |
| VOLCANOES  |    |            |   |    |                              |    |
| Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings, W83-00026  | 5C |            |   |    |                              |    |
| Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption, W83-00161                                       | 5A |            |   |    |                              |    |
| WAHIAWA RESERVOIR  |    |            |   |    |                              |    |
| Water Quality Simulation of Wahiawa Reservoir, Oahu, Hawaii, W83-00281   | 5G |            |   |    |                              |    |
|  |    |            |   |    |                              |    |

## SUBJECT INDEX

### **WASTEWATER TREATMENT**

|   |    |  |    |  |    |
|---|----|--|----|--|----|
| Recycling of Mercury and Silver from COD Tests,<br>W83-00145  | 5D | Preliminary Studies on the Treatment of Cannning Factory Effluent with an Integrated Bacterial-Algal-Fish System,<br>W83-00317           | 5D | Preconcentration of Environmental Tin and its Determination Using Catechol Violet,<br>W83-00348  | 5A |
| Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes,<br>W83-00149  | 5D | Treatment of Oily Wastewaters from Onshore Operations,<br>W83-00319  | 5D | <b>WATER CONSERVATION</b><br>Social and Political Aspects of Drought,<br>W83-00186   | 6B |
| Improvements in Foam Flotation for Lead Removal,<br>W83-00150   | 5D | Water Quality Criteria and Effluent Requirements in Broward County, Florida,<br>W83-00320  | 5G | Incentives for Irrigation Water Conservation in Agriculture,<br>W83-00278  | 3F |
| Advanced Treatment.<br>W83-00151  | 5D | The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,<br>W83-00327                                     | 5D | Conservation Through Crops Research,<br>W83-00311  | 3F |
| Sludge Digestion and Disposal.<br>W83-00152   | 5D | Advanced Biological Treatment to Achieve Nutrient Removal,<br>W83-00349  | 5D | <b>WATER CONVEYANCE</b><br>Chemical Stability of Water.<br>W83-00091   | 5F |
| Disinfection, Odor Prevention and Control.<br>W83-00154   | 5D | Municipal Pretreatment Program Development,<br>W83-00350   | 5D | Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,<br>W83-00241  | 6A |
| Pulp and Paper Effluent Management,<br>W83-00164  | 5D | <b>WASTEWATER TREATMENTS</b><br>Investigations on Cellulose Biodegradation in Activated Sludge Plants,<br>W83-00013                      | 5D | <b>WATER COSTS</b><br>High Plains - Ogallala Aquifer Study Water Transfer Element,<br>W83-00312  | 4A |
| Removing Soluble Organic Contaminants by Lime-Softening,<br>W83-00172   | 5F | <b>WATER ALLOCATION</b><br>Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,<br>W83-00250 | 6E | <b>WATER DISTRIBUTION</b><br>Mains and Services.<br>W83-00313  | 8C |
| Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,<br>W83-00177  | 5D | <b>WATER ANALYSIS</b><br>Simple Control Tests for Operators of Small Wastewater Treatment Plants,<br>W83-00092                           | 5D | Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes,<br>W83-00314   | 5F |
| Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,<br>W83-00179                                  | 5D | Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,<br>W83-00182               | 5A | Water Storage.<br>W83-00340  | 8C |
| Manpower Needs in Wastewater Treatment and Collection Systems for the Years 1980 to 2000,<br>W83-00180                                | 5G | Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,<br>W83-00194             | 5A | <b>WATER EFFICIENCY</b><br>Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,<br>W83-00234  | 3F |
| Water Management in the Oil Shale Industry,<br>W83-00185  | 5D | Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,<br>W83-00195                | 5A | <b>WATER HYACINTH</b><br>Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems,<br>W83-00324   | 5G |
| Digester Control Pays Dividends,<br>W83-00192   | 5D | Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,<br>W83-00227   | 5C | <b>WATER LAW</b><br>Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,<br>W83-00005   | 6B |
| Effect of a Bacterial Culture Product on Biological Kinetics,<br>W83-00212  | 5D | Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,<br>W83-00231  | 5A | Law,<br>W83-00165  | 6E |
| Non-Contacting Ultrasonic for Flow and Level Control,<br>W83-00221  | 5D | A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,<br>W83-00247   | 5G | Water Law Primer,<br>W83-00318   | 6E |
| Cause of Inefficient Solids Separation in the Activated Sludge Process,<br>W83-00232  | 5D | Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,<br>W83-00263  | 5C | <b>WATER LEVEL</b><br>Manual for Leveling at Gaging Stations in North Carolina,<br>W83-00065   | 7B |
| Wastewater Flocculation-Filtration and Post Disinfection,<br>W83-00239  | 5D | A Preliminary Study of Natural Aquifer Discharge of Guam,<br>W83-00271   | 5B | <b>WATER LEVEL FLUCTUATIONS</b><br>Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,<br>W83-00075 | 7C |
| High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,<br>W83-00243                         | 5D | The Chemical Composition of Water and the Analytical Chemist: A Challenge,<br>W83-00290  | 5A | <b>WATER MAINS</b><br>Cathodic Protection of Water Mains,<br>W83-00175   | 8G |
| Wastewater Management Problems in Rural Communities,<br>W83-00249   | 5G | Determination of Benzidines in Industrial and Municipal Wastewaters,<br>W83-00292  | 5A | Mains and Services.<br>W83-00313   | 8C |
| Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,<br>W83-00284 | 5D | Increasing Arcat Test Sensitivity for Examination of Potable Waters,<br>W83-00293  | 5F | Collection Systems.<br>W83-00338   | 8C |
| Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,<br>W83-00291                                       | 5D |  |    | System Maintenance.<br>W83-00339   | 8A |
| Sludge Disposal from Acid Mine Drainage Treatment,<br>W83-00298   | 5E |  |    | <b>WATER MANAGEMENT</b><br>The Nation's Water,<br>W83-00004  | 6D |
| Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes,<br>W83-00314                              | 5F |  |    |  |    |

## SUBJECT INDEX

|  |    |
|--|----|
| Water and Waste Management in the Canadian Meat and Poultry Processing Industry.   | 3E |
| W83-00082  |    |
| Water Management in the Oil Shale Industry.  | 5D |
| W83-00185  |    |
| Climatic Aspects of Droughts,  | 3F |
| W83-00188  |    |
| High Plains-Ogallala Aquifer Study, New Mexico - Economic Impacts,   | 6B |
| W83-00308  |    |
| <b>WATER MEASUREMENT</b>   |    |
| Metering, Monitoring and Quality Control.  | 8G |
| W83-00336  |    |
| <b>WATER METERING</b>  |    |
| Metering, Monitoring and Quality Control.  | 8G |
| W83-00336  |    |
| <b>WATER POLLUTION</b>   |    |
| Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,   | 5B |
| W83-00072  |    |
| A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,  | 5G |
| W83-00247  |    |
| <b>WATER POLLUTION CONTROL</b>   |    |
| A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,   | 5B |
| W83-00126  |    |
| Management and Control Technology for Urban Stormwater Pollution,  | 5G |
| W83-00148  |    |
| Water Quality Standards and Water Quality,   | 5G |
| W83-00162  |    |
| Water Law Primer,  | 6E |
| W83-00318  |    |
| Treatment of Oily Wastewaters from Onshore Operations,   | 5D |
| W83-00319  |    |
| <b>WATER POLLUTION EFFECTS</b>   |    |
| Municipal Point Source and Agricultural Non-point Source Contribution to Coastal Eutrophication,   | 5B |
| W83-00001  |    |
| Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,   | 5G |
| W83-00023  |    |
| Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,  | 5G |
| W83-00079  |    |
| Water Characteristics,   | 5B |
| W83-00169  |    |
| An Overview of Acid Rain Monitoring Activities in North America,   | 5C |
| W83-00189  |    |
| Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalve Molluscs from Oregon Estuaries,  | 5C |
| W83-00295  |    |
| The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion, | 5C |
| W83-00343  |    |
| <b>WATER POLLUTION PREVENTION</b>  |    |
| The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective,  | 5G |
| W83-00210  |    |

|  |    |
|--|----|
| <b>WATER POLLUTION SOURCES</b>   |    |
| Municipal Point Source and Agricultural Non-point Source Contribution to Coastal Eutrophication,   | 5B |
| W83-00001  |    |
| Water Quality of Streams in the Great Smoky Mountains National Park,   | 5B |
| W83-00032  |    |
| Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral,   | 5B |
| W83-00300  |    |
| <b>WATER PURIFICATION</b>  |    |
| Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultra-violet Detection,                | 5A |
| W83-00202  |    |
| <b>WATER QUALITY</b>   |    |
| Water Resources Data, Louisiana, Water Year 1981—Volume 2. Southern Louisiana.   | 7C |
| W83-00057  |    |
| Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data.  | 7C |
| W83-00058  |    |
| An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979,  | 5B |
| W83-00064  |    |
| Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee, | 5B |
| W83-00066  |    |
| Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,  | 5B |
| W83-00068  |    |
| Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,   | 5B |
| W83-00072  |    |
| Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana.   | 7C |
| W83-00076  |    |
| Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado,  | 7C |
| W83-00077  |    |
| Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,  | 7C |
| W83-00078  |    |
| Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980,   | 7C |
| W83-00113  |    |
| Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,  | 4B |
| W83-00114  |    |
| Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,   | 4A |
| W83-00123  |    |
| Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,  | 5A |
| W83-00124  |    |
| Designation of Principal Water-Supply Aquifers in Minnesota,   | 2F |
| W83-00125  |    |
| A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,   | 5B |
| W83-00126  |    |
| <b>WATER RENOVATION</b>  |    |
| Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,   | 5B |
| W83-00129  |    |
| Water Resources Data for New York, Water Year 1981—Volume 3. Western New York.   | 7C |
| W83-00131  |    |
| Water Resources Data for North Carolina, Water Year 1981.  | 7C |
| W83-00132  |    |
| Water Characteristics,   | 5B |
| W83-00169  |    |
| U.S. Geological Survey Federal-State Program,  | 6E |
| W83-00201  |    |
| A Cooperative Water Resource Technology Transfer Program,  | 6B |
| W83-00216  |    |
| Coliform Attachment to Suspended Particles in Stormwater,  | 5B |
| W83-00224  |    |
| Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,                                     | 5B |
| W83-00304  |    |
| <b>WATER QUALITY CONTROL</b>   |    |
| Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs,  | 5C |
| W83-00009  |    |
| Simple Control Tests for Operators of Small Wastewater Treatment Plants,   | 5D |
| W83-00092  |    |
| Phosphate and Wind in a Shallow Lake,  | 5B |
| W83-00184  |    |
| Water Quality Criteria and Effluent Requirements in Broward County, Florida,   | 5G |
| W83-00320  |    |
| <b>WATER QUALITY MANAGEMENT</b>  |    |
| Water Quality of Streams in the Great Smoky Mountains National Park,   | 5B |
| W83-00032  |    |
| Water Quality Simulation of Wahiawa Reservoir, Oahu, Hawaii,   | 5G |
| W83-00281  |    |
| <b>WATER QUALITY STANDARDS</b>   |    |
| Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,  | 5G |
| W83-00079  |    |
| New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,   | 5G |
| W83-00137  |    |
| Water Quality in Urban Streams—What we can Expect,   | 5C |
| W83-00144  |    |
| Water Quality Standards and Water Quality,   | 5G |
| W83-00162  |    |
| Developing and Applying International Water Quality Guidelines,  | 5G |
| W83-00167  |    |
| Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields,                                      | 5B |
| W83-00228  |    |
| <b>WATER RENOVATION</b>  |    |
| Water Reclamation and Reuse,   | 5D |
| W83-00163  |    |

## SUBJECT INDEX

### **WATER RESOURCE DEVELOPMENT**

**WATER RESOURCE DEVELOPMENT**  
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240 6B

**WATER RESOURCES DEVELOPMENT**  
Environmental Impact of Large Hydroelectric Projects on Tropical Countries, W83-00010 6G

Irrigation Planning in the Tana Basin of Kenya, W83-00015 6B

Groundwater is the Answer to Zambia's Water Problem, W83-00225 4B

Remote Sensing of Water Resources on Pacific Islands, W83-00262 7C

Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I, W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II, W83-00274 10D

Final Environmental Impact Statement of the White River Dam Project, W83-00297 6G

**WATER REUSE**  
Water Reclamation and Reuse, W83-00163 5D

**WATER RIGHTS**  
Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska, W83-00250 6E

**WATER SOFTENING**  
Softening, Iron and Manganese Removal, W83-00342 5F

**WATER STORAGE**  
The Water Supply of the Brussels Urban Area and its Surroundings, W83-00020 5F

Water Storage, W83-00340 8C

**WATER STRESS**  
Dendrography for Optimal Water and Energy Utilization in Plant Growth, W83-00265 3F

**WATER SUPPLY**  
The Nation's Water, W83-00004 6D

The Water Supply of the Brussels Urban Area and its Surroundings, W83-00020 5F

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico, W83-00078 7C

Hydrology and Water Resources of the Drakensberg, W83-00085 4A

Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida, W83-00114 4B

Designation of Principal Water-Supply Aquifers in Minnesota, W83-00125 2F

Social and Political Aspects of Drought, W83-00186 6B

**U.S. Geological Survey Federal-State Program, W83-00201** 6E

A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management, W83-00247 5G

Water Treatment for Small Public Supplies, W83-00280 5F

Water Quality Simulation of Wahiawa Reservoir, O'ahu, Hawaii, W83-00281 5G

Blackheath Water Treatment Plant, W83-00283 5F

Estimating Hydrologic Values for Planning Wildland Fire Protection, W83-00306 6B

**WATER SUPPLY DEVELOPMENT**  
Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study, W83-00229 3D

**WATER SUPPLY SYSTEMS**  
Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study, W83-00229 3D

**WATER TEMPERATURE**

The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada, W83-00060 4B

**WATER TRANSFER**

An Alternative to the Peripheral Canal, W83-00193 6G

High Plains - Ogallala Aquifer Study Water Transfer Element, W83-00312 4A

**WATER TRANSPORT**  
Large Water Transport Pumps, W83-00206 8C

**WATER TREATMENT**

The Water Supply of the Brussels Urban Area and its Surroundings, W83-00020 5F

Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System, W83-00024 5G

Chemical Stability of Water, W83-00091 5F

Rapid-Mix Design for Mechanisms of Alum Coagulation, W83-00170 5F

Adsorption of Toxic and Carcinogenic Compounds from Water, W83-00171 5F

Removing Soluble Organic Contaminants by Lime-Softening, W83-00172 5F

West River Gets Innovative Technology, W83-00197 5F

New Technology for Drinking Water Treatment, W83-00198 5F

High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment, W83-00243 5D

Water Treatment for Small Public Supplies, W83-00280 5F

Blackheath Water Treatment Plant, W83-00283 5F

Increasing Arcat Test Sensitivity for Examination of Potable Waters, W83-00293 5F

Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes, W83-00314 5F

Water Supply and Treatment, Section C-1, Raw Water Preparation, W83-00335 5F

### **WATER TREATMENT FACILITIES**

Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View, W83-00135 5F

Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View, W83-00136 5F

Non-Contacting Ultrasonic for Flow and Level Control, W83-00221 5D

Blackheath Water Treatment Plant, W83-00283 5F

### **WATER USE**

U.S. Geological Survey Federal-State Program, W83-00201 6E

Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska, W83-00250 6E

Water Law Primer, W83-00318 6E

### **WATER WELLS**

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana, W83-00076 7C

### **WATER YIELD**

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1980 Water Year, W83-00063 4A

### **WATER YIELD IMPROVEMENT**

Angora Goats for Conversion of Arizona Chaparral: Early Results, W83-00299 3B

Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral, W83-00300 5B

Water Yield Changes Resulting from Treatment of Arizona Chaparral, W83-00303 3B

### **WATERSHED MANAGEMENT**

Water Quality of Streams in the Great Smoky Mountains National Park, W83-00032 5B

Testing the Modified Universal Soil Loss Equation, W83-00107 4D

Water Yield Changes Resulting from Treatment of Arizona Chaparral, W83-00303 3B

### **WATERSHEDS**

IHRR Distributed Parameter Watershed Model, W83-00269 2E

Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed, W83-00346 2D

**SUBJECT INDEX****ZOOPLANKTON**

Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States, W83-00347 2A

**WEATHER FORECASTING**

A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia, W83-00289 2B

**WELL WATER**

Use of Fracture Traces in Water Well Location: a Handbook, W83-00217 4B

**WELLS**

Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas, W83-00075 7C

**WEST GERMANY**

Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters, W83-00045 5A

The Sediments of the New Artificial Lake Boslalsee (Saarland, Germany), with Particular Reference to Microbial Activity, W83-00048 5C

Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake, W83-00315 5G

**WETLANDS**

Nutrient Removal From Wastewater by Wetlands, W83-00226 5D

**WHITE RIVER**

Final Environmental Impact Statement of the White River Dam Project, W83-00297 6G

**WILDLIFE HABITATS**

The Ecology of the Mangroves of South Florida: A Community Profile, W83-00093 6G

**WIND VELOCITY**

Phosphate and Wind in a Shallow Lake, W83-00184 5B

**WISCONSIN**

Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin, W83-00123 4A

**WYOMING**

Streamflows and Channels of the Green River Basin, Wyoming, W83-00122 4A

Instream Salmonid Habitat Exclusion by Ice-Cover, W83-00257 8I

**ZAMBIA**

Groundwater is the Answer to Zambia's Water Problem, W83-00225 4B

**ZOOPLANKTON**

Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India, W83-00027 2H

Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya, W83-00056 5B



## AUTHOR INDEX

|  |    |   |    |  |    |
|--|----|---|----|--|----|
| <b>AARONSON, S.</b><br>The Relationship Between Nutrient Status and Chemical Composition of <i>Peridinium Cinctum</i> During the Bloom in Lake Kinneret, W83-00333 | 5C | <b>ANDERSON, H. W.</b><br>Estimating Hydrologic Values for Planning Wildland Fire Protection, W83-00306                                     | 6B | <b>BASHFORD, D. J.</b><br>The Incidence of <i>Vibrio Cholerae</i> in Water, Animals and Birds in Kent, England, W83-00012  | 5B |
| <b>ABBOTT, M. R.</b><br>In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light, W83-00141   | 5C | <b>ANDERSON, R. J. JR.</b><br>The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation, W83-00016 | 6A | <b>BAXTER, K. M.</b><br>The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom, W83-00220  | 5E |
| <b>ACKMAN, T. E.</b><br>Sludge Disposal from Acid Mine Drainage Treatment, W83-00298   | 5E | <b>ARBLITBLIT, D. C.</b><br>The Plight of American Citizens Injured by Transboundary River Pollution, W83-00209                             | 6E | <b>BEARD, K. V.</b><br>Non-Contacting Ultrasonic for Flow and Level Control, W83-00221   | 5D |
| <b>ADAMSON, P. T.</b><br>The Analyses of Areal Rainfall Using Multi-Quadratic Surfaces, W83-00088  | 2B | <b>ARNAC, P.</b><br>A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation, W83-00205                  | 8G | <b>BECKFORD, S.</b><br>Tracing Well Water Pollution in a Limestone Aquifer, W83-00173  | 5B |
| The Statistics of Extreme Values and the Analysis of Floods in South Africa, W83-00089   | 2E | <b>ARNDT, B. M.</b><br>Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota, W83-00236                         | 5E | <b>BELL, G. R.</b><br>Diatomite Precast Filtration for Pretreatment of Seawater Prior to Reverse Osmosis, W83-00270  | 3A |
| <b>ADOLPHSON, D. G.</b><br>Designation of Principal Water-Supply Aquifers in Minnesota, W83-00125  | 2F | <b>ARNELL, V.</b><br>Estimating Runoff Volumes from Urban Areas, W83-00007  | 4A | <b>BELLI, J. L.</b><br>Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York, W83-00117  | 7C |
| <b>AHERN, J.</b><br>Evaluation of Limnological Parameters as Related to the Success of <i>Mysis relicta</i> Introductions, W83-00254                               | 8I | <b>ARUNACHALAM, M.</b><br>Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India, W83-00027                          | 2H | Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069  | 7C |
| <b>AHMAD, I.</b><br>Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography, W83-00014                                 | 5A | <b>ASLAM, S.</b><br>Recycling of Mercury and Silver from COD Tests, W83-00145   | 5D | <b>BENTZ, A. P.</b><br>Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy, W83-00231  | 5A |
| <b>ALLANSON, B. R.</b><br>An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake, W83-00053                             | 5C | <b>AUSTIN, A. E.</b><br>Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222       | 3A | <b>BERG, B. M.</b><br>Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa, W83-00218  | 4D |
| <b>ALLEN, R. V.</b><br>Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York, W83-00117  | 7C | <b>AUSTIN, T. A.</b><br>Efficient Use of Water for Irrigation in the Upper Midwest, W83-00242   | 3F | <b>BERGLIND, L.</b><br>Adsorption of PAH to Aquatic Humus, W83-00038   | 5B |
| Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-0016  | 7C | Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis, W83-00241  | 6A | <b>BERMAN, T.</b><br>The Relationship Between Nutrient Status and Chemical Composition of <i>Peridinium Cinctum</i> During the Bloom in Lake Kinneret, W83-00333                         | 5C |
| <b>ALM, J. L.</b><br>Increasing Arcat Test Sensitivity for Examination of Potable Waters, W83-00293  | 5F | <b>BABCOCK, W. C.</b><br>Development of Composite Hollow Fibers - Phase III, W83-00267  | 3A | <b>BERTENSHAW, M. P.</b><br>Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters, W83-00195                                       | 5A |
| <b>AMBROISE, B.</b><br>Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed, W83-00346   | 2D | <b>BAKER, J. L.</b><br>Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land, W83-00264              | 5B | <b>BEVERS, J.</b><br>Investigations on Cellulose Biodegradation in Activated Sludge Plants, W83-00013  | 5D |
| <b>AMIRTHARAJAH, A.</b><br>Rapid-Mix Design for Mechanisms of Alum Coagulation, W83-00170  | 5F | <b>BAKER, R. W.</b><br>Development of Composite Hollow Fibers - Phase III, W83-00267  | 3A | <b>BHAGAT, S. K.</b><br>Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes, W83-00149  | 5D |
| <b>ANDEEN, G. B.</b><br>Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device, W83-00256   | 3A | <b>BALAKRISHNAN NAIR, N.</b><br>Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India, W83-00027                    | 2H | <b>BISCHOFBERGER, H.</b><br>Wastewater Flocculation-Filtration and Post Disinfection, W83-00239  | 5D |
| <b>ANDERSON, C. E.</b><br>Efficient Use of Water for Irrigation in the Upper Midwest, W83-00242  | 3F | <b>BALASUBRAMANIAN, N. K.</b><br>Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India, W83-00027                   | 2H | <b>BLIGHT, G. E.</b><br>The Flow of Slurry from a Breached Tailings Dam, W83-00285   | 8B |
| <b>ANDERSON, C. P.</b><br>Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy, W83-00231   | 5A | <b>BALL, R.</b><br>Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works, W83-00291                             | 5D | <b>BLUMER, S. P.</b><br>Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma, W83-00110 | 7C |
| <b>ANDERSON, H. R.</b><br>Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069                    | 7C | <b>BARSS, R. P.</b><br>Development of Composite Hollow Fibers - Phase III, W83-00267  | 3A |  |    |

## AUTHOR INDEX

**BLUMM, M. C.**

**BLUMM, M. C.**  
The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective, W83-00210

5G

**BOGESS, D. H.**  
Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida, W83-00114

4B

**BOKN, T.**  
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water, W83-00330

5B

**BORST, R. J.**  
Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips, W83-00326

5D

**BOTES, P. J.**  
Stabilizing High-Strength Wastes with Photosynthetic Bacteria, W83-00181

5D

**BOWEN, H. J. M.**  
Preconcentration of Environmental Tin and its Determination Using Catechol Violet, W83-00348

5A

**BRAND, J. G.**  
Blackheath Water Treatment Plant, W83-00283

5F

**BRIGGS, R.**  
Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes, W83-00314

5F

**BROBERG, O.**  
Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden, W83-00050

5C

**BROCK, J. H.**  
Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona, W83-00301

4D

**BRODIN, Y.**  
Paleoecological Studies of the Recent Development of the Lake Vaxjöson. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids, W83-00028

5C

**BROWN, D. P.**  
Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida, W83-00068

5B

**BROWN, G. A.**  
Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-00116

7C

**BROWN, J. A. JR.**  
Biooxidation of Paint Process Wastewater, W83-00143

5D

**BRYANT, J. O. JR.**  
Manpower Needs in Wastewater Treatment and Collection Systems for the Years 1980 to 2000, W83-00180

5G

**BUCHANAN, T. J.**  
U.S. Geological Survey Federal-State Program, W83-00201

6E

**BURDICK, C. R.**  
Advanced Biological Treatment to Achieve Nutrient Removal, W83-00349

5D

**BURFORD, J. B.**

Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973, W83-00095

7C

**BURGER, C. P.**

Dendrography for Optimal Water and Energy Utilization in Plant Growth, W83-00265

3F

**BURGESS, S. J.**

Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study, W83-00229

3D

**BURTON, G. W.**

Groundwater is the Answer to Zambia's Water Problem, W83-00225

4B

**BUSCH, A. W.**

Bioassay Technique for Relative Toxicity in Water Pollution Control, W83-00146

5A

**CABASSO, I.**

Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation—Part III, W83-00259

3A

**CADDY, D. E.**

Practical Techniques of River Monitoring and Pollution Forecasting, W83-00238

5B

**CALABRESE, E. J.**

Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts, W83-00139

5B

**CALKIN, H. W.**

Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral, W83-00307

2I

**CAMPBELL, E.**

Plumline Monitor Interface, W83-00094

8G

**CAMPER, N. D.**

Aerobic Degradation of Diuron by Aquatic Microorganisms, W83-00002

5B

**CARLSON, R. E.**

Stratigraphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery, W83-00329

2H

**CAROTHERS, W. W.**

Methods for Collection and Analysis of Geopressed Geothermal and Oil Field Waters, W83-00127

2K

**CARY, L. E.**

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980, W83-00074

7C

**CHANG, T. J.**

Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes, W83-00282

2E

**CHANG, T. P.**

Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms, W83-00183

5C

**CHAPMAN, P. M.**

Design of Monitoring Studies for Priority Pollutants, W83-00321

7A

**CHOINSKI, E. M.**

Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover, W83-00255

8I

**CHRISTENSON, S. C.**

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma, W83-00110

7C

**CHRISTMAN, R. F.**

Structural Characterization of Aquatic Humic Material, W83-00190

5C

**CLEVELAND, J. M.**

Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant, W83-00019

5B

**CLOETE, T. E.**

Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System, W83-00317

5D

Stabilizing High-Strength Wastes with Photosynthetic Bacteria, W83-00181

5D

**COFFIN, J. E.**

Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980, W83-00113

7C

**COHON, J. L.**

Reservoir Management in Potomac River Basin, W83-00203

6A

**CONTRACTOR, D. N.**

Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands, W83-00268

8C

Remote Sensing of Water Resources on Pacific Islands, W83-00262

7C

**CONWAY, M. F.**

Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms, W83-00214

5B

**COOKE, G. D.**

Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques, W83-00006

5C

**COOKE, M. G.**

Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents, W83-00204

5A

**COOLEY, R. V.**

Municipal Pretreatment Program Development, W83-00350

5D

**COONEY, J. J.**

Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters, W83-00219

5B

**CORBUS, F. G.**

Aquatic Weed Control with Endothall in a Salt River Project Canal, W83-00166

4A

**COX, W. E.**

Water Law Primer, W83-00318

6E

**CROLEY, T. E. II.**

IHRI Distributed Parameter Watershed Model, W83-00269

2E

## AUTHOR INDEX

EVANS, W. C.

**CROWLEY, K. D.**  
Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing, W83-00111 4D

**CURTIN, S. E.**  
Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981, W83-00115 7C

**DITTRI, F. M.**  
A Cooperative Water Resource Technology Transfer Program, W83-00216 6B

**DAGUE, R. R.**  
High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment, W83-00243 5D

**DANIELS, M. L.**  
High-Quality Trickling Filter Effluent Without Tertiary Treatment, W83-00142 5D

**DASCHBACH, M. H.**  
Lake Restoration Technology Transfer Assessment, W83-00215 5G

**DAVIS, C. B.**  
The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh, W83-00266 5G

**DAVIS, D. R.**  
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands, W83-00223 6G

**DAVIS, E. A.**  
Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral, W83-00300 5B

Water Yield Changes Resulting from Treatment of Arizona Chaparral, W83-00303 3B

**DAVIS, R. E.**  
Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma, W83-00110 7C

**DE BOER, T.**  
Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands, W83-00039 5B

**DE GROOT, W. T.**  
Phosphate and Wind in a Shallow Lake, W83-00184 5B

**DE HAAN, H.**  
Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands, W83-00039 5B

**DEBANO, L. F.**  
Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona, W83-00301 4D

**DEENY, K.**  
Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works, W83-00291 5D

**DELLEUR, J. W.**  
Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes, W83-00282 2E

**DEMAYO, A.**  
Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper, W83-00079 5G

**DEPETRIS, P. J.**  
A Principal Components Analysis of the Phytoplankton from a Pond in the Paraná River Valley, Argentina, W83-00022 5C

**DEPINTO, J. V.**  
An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation, W83-00245 5G

**DESOUZA, A.**  
Increasing Arcat Test Sensitivity for Examination of Potable Waters, W83-00293 5F

**DEWEZ, A.**  
Some Aspects of the Colonization by Water Mites (Acarí, Actinedida) of an Artificial Substrate in a Disturbed Environment, W83-00054 5C

**DIAMOND, J.**  
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact, W83-00005 6B

**DICK, R. L.**  
Cause of Inefficient Solids Separation in the Activated Sludge Process, W83-00232 5D

**DICKEY, J.**  
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds, W83-00302 4D

**DICKMAN, M. D.**  
The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment, W83-00042 5C

**DIERING, J. A. C.**  
The Flow of Slurry from a Breached Tailings Dam, W83-00285 8B

**DINEEN, R. J.**  
Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069 7C

**DISSMEYER, G. E.**  
Developing a USLE Cover-Management (C) Factor Procedure for Forest Conditions, W83-00108 4D

**DIVAKARAN, O.**  
Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India, W83-00027 2H

**DIXON, J. E.**  
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover), W83-00252 5G

**DONOVAN, T. J.**  
The Incidence of *Vibrio Cholerae* in Water, Animals and Birds in Kent, England, W83-00012 5B

**DRAPER, S. H.**  
Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study, W83-00229 3D

**DREWS, R. J. L. C.**  
Simple Control Tests for Operators of Small Wastewater Treatment Plants, W83-00092 5D

**DU TOIT, P. J.**  
Stabilizing High-Strength Wastes with Photosynthetic Bacteria, W83-00181 5D

**DUCRET, G. L. JR.**  
Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas-Oklahoma, 1980 Water Year, W83-00063 4A

**DUDA, A. M.**  
Municipal Point Source and Agricultural Non-point Source Contribution to Coastal Eutrophication, W83-00001 5B

Water Quality in Urban Streams—What we can Expect, W83-00144 5C

**DUNN, J. R.**  
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection, W83-00182 5A

**DUNN, P. H.**  
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds, W83-00302 4D

**DURAN, R. M.**  
Water Treatment for Small Public Supplies, W83-00280 5F

**EASTLIN, J. D.**  
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield, W83-00234 3F

**EATON, J. W.**  
The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion, W83-00343 5C

**EDZWALD, J. K.**  
An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation, W83-00245 5G

**EIBLING, J. A.**  
Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222 3A

**EID, J. C.**  
Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device, W83-00256 3A

**ELLIS, B. G.**  
Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields, W83-00228 5B

**ELLIS, P. A.**  
Aerobic Degradation of Diuron by Aquatic Microorganisms, W83-00002 5B

**ENGELBRECHT, A. H.**  
The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species, W83-00288 5C

**ENGMAN, E. T.**  
Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States, W83-00347 2A

**EVANS, W. C.**  
Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington, W83-00112 2K

## AUTHOR INDEX

**FELTIS, R. D.**

**FELTIS, R. D.**  
Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana, W83-00076 7C

**FENLON, J. S.**  
Chemical Surveillance of Rivers, W83-00134 5A

**FENTON, T.**  
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land, W83-00264 5B

**FERRY, W. K.**  
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240 6B

**FIELD, S. J.**  
Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin, W83-00123 4A

**FILLER, J. R.**  
Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis, W83-00251 2E

**FINNEMORE, E. J.**  
Management and Control Technology for Urban Stormwater Pollution, W83-00148 5G

**FIUTEM, R. A.**  
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection, W83-00182 5A

**FOGEL, M. M.**  
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands, W83-00223 6G

**POSHEE, W. C.**  
Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation, W83-00177 5D

**FOSTER, G. R.**  
Estimating Sediment Yield from Rangeland with CREAMS, W83-00103 2J

**Relation of USLE Factors to Erosion on Rangeland, W83-00096** 2J

**Special Problems in the Application of the USLE to Rangelands: C and P Factors, W83-00100** 2J

**FOUTCH, R.**  
Increasing Arcat Test Sensitivity for Examination of Potable Waters, W83-00293 5F

**FOX, R. L.**  
Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates, W83-00246 3A

**FRANCIS, C. A.**  
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield, W83-00234 3F

**FREMPTONG, E.**  
Diel Periodicity in the Chemical Composition of Lake Phytoplankton, W83-00049 5B

**FRENZEL, P.**  
The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger

**Becken, A** Shallow Littoral Part of Lake Constance, W83-00036 2H

**FRITZ, S. C.**  
Stratigraphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery, W83-00329 2H

**FURNISS, A. L.**  
The Incidence of *Vibrio Cholerae* in Water, Animals and Birds in Kent, England, W83-00012 5B

**GAIGHER, I. G.**  
Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System, W83-00317 5D

**GANNON, J. J.**  
Coliform Attachment to Suspended Particles in Stormwater, W83-00224 5B

**GARCIA DE EMILIANI, M. O.**  
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina, W83-00022 5C

**GARD, T. C.**  
Persistence in Model Ecosystems, W83-00294 5B

**GEHRARDT, K. A.**  
Predicting Sediment Yields from Sagebrush Rangelands, W83-00106 4D

**Use of Erosion Models on Western Rangelands, W83-00097** 2J

**GEIGER, N. S.**  
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings, W83-00026 5C

**GIBBS, J. W.**  
Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado, W83-00077 7C

**GIETA, R. J.**  
Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study, W83-00083 5D

**GILBERT, B. K.**  
U.S. Geological Survey Federal-State Program, W83-00201 6E

**GILLESPIE, B. D.**  
Low-Flow Characteristics and Flow Duration of New Jersey Streams, W83-00061 7C

**GILLEY, J. R.**  
Irrigation Scheduling, W83-00310 3F

**GINOCCHIO, J. C.**  
Wastewater Flocculation-Filtration and Post Disinfection, W83-00239 5D

**GJESSING, E. T.**  
Adsorption of PAH to Aquatic Humus, W83-00038 5B

**GMUNDER, A.**  
Wastewater Flocculation-Filtration and Post Disinfection, W83-00239 5D

**GODDARD, K. E.**  
Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado, W83-00168 4C

**GOLCHIN, J.**  
Efficient Use of Water for Irrigation in the Upper Midwest, W83-00242 3F

**GOMEZ-GOMEZ, F.**  
Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites, W83-00072 5B

**GORE, J. A.**  
Instream Salmonid Habitat Exclusion by Ice-Cover, W83-00257 8I

**GOVE, G. W.**  
Pulp and Paper Effluent Management, W83-00164 5D

**GRABOWSKI, J. J.**  
Evaluation of Limnological Parameters as Related to the Success of *Mysis relicta* Introductions, W83-00254 8I

**GRADY, C. P. L. JR.**  
Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics, W83-00179 5D

**GRAHAM, D. D.**  
Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee, W83-00066 5B

**GRAUER, T.**  
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land, W83-00264 5B

**GREEN, G. C.**  
A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies, W83-00287 2D

**GREGORY, E. J.**  
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I, W83-00235 3F

**GREGORY, R. W.**  
Physicochemical Limnology of the Tongue River Reservoir, Montana, W83-00033 2H

**GRIEPINK, B.**  
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis, W83-00046 5A

**GROS, H.**  
Wastewater Flocculation-Filtration and Post Disinfection, W83-00239 5D

**GULENS, J.**  
Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents, W83-00204 5A

**GUPTA, G.**  
Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems, W83-00324 5G

**GUTENTAG, E. D.**  
Geohydrology of Southwestern Kansas, W83-00059 7C

**HAGAN, G. F.**  
Low Flow of Streams in Fairfax County, Virginia, W83-00062 4C

## AUTHOR INDEX

JOHNSON, H. P.

|   |    |  |    |   |    |
|---|----|--|----|---|----|
| <b>HAINES, T. A.</b><br>Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review, W83-00331   | 5C | <b>HIBBERT, A. R.</b><br>Water Yield Changes Resulting from Treatment of Arizona Chaparral, W83-00303  | 3B | <b>HRUDEY, S. E.</b><br>Water Reclamation and Reuse, W83-00163  | 5D |
| <b>HALL, R. B.</b><br>Dendrography for Optimal Water and Energy Utilization in Plant Growth, W83-00265  | 3F | <b>HICKEY, J. J.</b><br>Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida, W83-00129       | 5B | <b>HUANG, J. Y. C.</b><br>Wastewater Management Problems in Rural Communities, W83-00249  | 5G |
| <b>HANBURY, R. G.</b><br>The Ecological Effects of 2-Methylthiouracil Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion, W83-00343 | 5C | <b>HICKMAN, M.</b><br>Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy), W83-00316 | 2H | <b>HULL, J. A.</b><br>Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981, W83-00071                           | 2E |
| <b>HANSFORD, G. S.</b><br>A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters, W83-00138  | 5D | <b>HIGGINS, A. J.</b><br>Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential, W83-00233               | 5E | <b>HUNTER, R. M.</b><br>Municipal Pretreatment Program Development, W83-00350   | 5D |
| <b>HARRIS, M.</b><br>Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works, W83-00291   | 5D | <b>HIGGINS, J.</b><br>Digester Control Pays Dividends, W83-00192   | 5D | <b>HURLEY, D. G.</b><br>Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240          | 6B |
| <b>HART, G. E.</b><br>A Test of the USLE on Bare and Sagebrush Plots in Utah, W83-00101   | 4D | <b>HIMES, R. C.</b><br>Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis, W83-00270                           | 3A | <b>HUTCHINSON, C.</b><br>Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation, W83-00230           | 3F |
| <b>HARTIG, J. H.</b><br>Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs, W83-00147   | 5G | <b>HINMAN, D. D.</b><br>Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover), W83-00252                    | 5G | <b>HUTSON, J. L.</b><br>A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies, W83-00287                            | 2D |
| <b>HASS, J. R.</b><br>Structural Characterization of Aquatic Humic Material, W83-00190  | 5C | <b>HIRSCH, R. M.</b><br>Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia, W83-00128          | 4A | <b>ILMAVIRTA, V.</b><br>Dynamics of Phytoplankton in Finnish Lakes, W83-00153   | 5C |
| <b>HATTINGH, W. H. J.</b><br>The Chemical Composition of Water and the Analytical Chemist: A Challenge, W83-00290   | 5A | <b>HIGGINS, J.</b><br>A Study of Trends in Total Phosphorus Measurements at Nasqan Stations, W83-00126   | 5B | <b>ISBISTER, J. D.</b><br>Increasing Arcat Test Sensitivity for Examination of Potable Waters, W83-00293                                      | 5F |
| <b>HATTULA, M.-L.</b><br>The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System, W83-00332  | 5B | <b>HOEKS, J.</b><br>Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips, W83-00326                                      | 5D | <b>JACKSON, N. M. JR.</b><br>Manual for Leveling at Gaging Stations in North Carolina, W83-00065  | 7B |
| <b>HEDMAN, E. R.</b><br>Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin, W83-00121  | 4D | <b>HOLTMAN, S.</b><br>Algae Removal by Induced Air Flotation, W83-00277  | 5G | <b>JAIN, S. C.</b><br>IIHR Distributed Parameter Watershed Model, W83-00269   | 2E |
| <b>HEGEWALD, E.</b><br>Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses, W83-00037   | 2H | <b>HOOGVELD, H. L.</b><br>Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands, W83-00039      | 5B | <b>JANSSEN, H. M. J.</b><br>Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis, W83-00046      | 5A |
| <b>HEISLER, M. D.</b><br>Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates, W83-00246  | 3A | <b>HOPPER, W. M. JR.</b><br>Groundwater in the Inner Bluegrass Karst Region, Kentucky, W83-00275   | 2F | <b>JANSSON, M.</b><br>Characterization of Acid Phosphatases in the Acidified Lake Gardsjön, Sweden, W83-00050                                 | 5C |
| <b>HEITZ, L. F.</b><br>Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis, W83-00251   | 2E | <b>HORVATH, F. J.</b><br>Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs, W83-00147                                 | 5G | <b>JANSSON, C. W.</b><br>Induction of High Phosphatase Activity by Aluminum in Acid Lakes, W83-00029  | 5B |
| <b>HEKMAN, L. H. JR.</b><br>The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands, W83-00223                               | 6G | <b>HOWARD, C. C.</b><br>Determination of Benzidines in Industrial and Municipal Wastewaters, W83-00292   | 5A | <b>JOHNSON, C. W.</b><br>Predicting Sediment Yields from Sagebrush Rangelands, W83-00106  | 4D |
| <b>HENDERSON, K. W.</b><br>West River Gets Innovative Technology, W83-00197   | 5F | <b>HOWARD, R. B.</b><br>Erosion and Sedimentation as Part of the Natural System, W83-00305   | 2J | <b>JOHNSON, D. W.</b><br>Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover, W83-00255 | 8I |
| <b>HERRINGTON, H. D.</b><br>Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents, W83-00204   | 5A | <b>HOWARD-WILLIAMS, C.</b><br>An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake, W83-00053     | 5C | <b>JOHNSON, H. P.</b><br>Efficient Use of Water for Irrigation in the Upper Midwest, W83-00242  | 3F |
|   |    |  |    | Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land, W83-00264                                       | 5B |

## AUTHOR INDEX

**JOHNSON, J. D.**

**JOHNSON, J. D.**  
Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980, W83-00074 7C

Structural Characterization of Aquatic Humic Material, W83-00190 5C

**JOHNSON, J. H. JR.**  
Cause of Inefficient Solids Separation in the Activated Sludge Process, W83-00232 5D

**JOHNSON, L. S.**  
Instream Salmonid Habitat Exclusion by Ice-Cover, W83-00257 8I

**JONES, R. A.**  
Water Quality Standards and Water Quality, W83-00162 5G

**JORGENSEN, S. S.**  
Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis, W83-00194 5A

**JOSEPHSON, J.**  
Fixed-Film Biological Processes, W83-00191 5D

**JUDD, J. H.**  
Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake, W83-00227 5C

**KAJILA, S.**  
Incentives for Irrigation Water Conservation in Agriculture, W83-00278 3F

**KALLSON, C. E.**  
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I, W83-00235 3F

**KANE, G. A.**  
Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts, W83-00139 5B

**KAVVAS, M. L.**  
Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes, W83-00282 2E

**KAWAHARA, F. K.**  
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection, W83-00182 5A

**KEEFE, P. N.**  
Intensive Flow Monitoring—Cost-Effectiveness with a Quality Edge, W83-00200 5G

**KELLY, M. G.**  
Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers, W83-00051 5B

**KEMPSTER, P. L.**  
The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent, W83-00084 2B

**KENNEDY, R. H.**  
Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques, W83-00006 5C

**KHARAKA, Y. K.**  
Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters, W83-00127 2K

**KIMBER, A. R.**  
The Use of Oxygen to Upgrade the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works, W83-00133 5D

**KINSLEY, R. K.**  
Social and Political Aspects of Drought, W83-00186 6B

**KINSMAN, J. D.**  
An Overview of Acid Rain Monitoring Activities in North America, W83-00189 5C

**KITANIDIS, P. K.**  
Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time, W83-00248 4A

**KLARER, D. M.**  
Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy), W83-00316 2H

**KLEIN, J. M.**  
Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption, W83-00161 5A

**KLIMPEL, R. R.**  
Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation, W83-00177 5D

**KNIPE, O. D.**  
Angora Goats for Conversion of Arizona Chaparral: Early Results, W83-00299 3B

Water Yield Changes Resulting from Treatment of Arizona Chaparral, W83-00303 3B

**KOOPMAN, R. T.**  
Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View, W83-00136 5F

**KOTZ, K. T.**  
Association Studies of Polybrominated Biphenyls in Aquatic Systems, W83-00160 5B

**KOZLOSKI, R. P.**  
Multiple Purge Techniques for Determining Organic Pollutants in Groundwater, W83-00158 5A

**KRUG, F. J.**  
Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis, W83-00194 5A

**KRUSE-SMITH, B. A.**  
Development of Composite Hollow Fibers - Phase III, W83-00267 3A

**KUMAR, S.**  
IIHR Distributed Parameter Watershed Model, W83-00269 2E

**KVESETH, K.**  
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water, W83-00330 5B

**LAFLEN, J. M.**  
Use of Rainfall Simulators to Determine Parameters for Erosion Prediction, W83-00102 2J

**LAMBERT, B. K.**  
Incentives for Irrigation Water Conservation in Agriculture, W83-00278 3F

**LAMBRECHTS, J. J.**  
Adjustment of Soil Limitations, W83-00286 2G

**LANDERS, D. H.**  
Effects of the Burrowing Mayfly, *Hexagenia*, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms, W83-00030 5C

**LANDSBERG, H. E.**  
Climatic Aspects of Droughts, W83-00188 3F

**LANE, L. J.**  
Estimating Sediment Yield from Rangeland with CREAMS, W83-00103 2J

Modeling Erosion in Overland Flow, W83-00104 4D

**LANSFORD, R. R.**  
High Plains-Ogallala Aquifer Study, New Mexico - Economic Impacts, W83-00308 6B

**LARSON, D. W.**  
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings, W83-00026 5C

**LARSON, G. L.**  
Water Quality of Streams in the Great Smoky Mountains National Park, W83-00032 5B

**LASS, D. A.**  
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact, W83-00005 6B

**LAUX, C. H.**  
Large Water Transport Pumps, W83-00206 8C

**LAWRENCE, G. B.**  
Effects of the Burrowing Mayfly, *Hexagenia*, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms, W83-00030 5C

**LEATHE, S. A.**  
Physicochemical Limnology of the Tongue River Reservoir, Montana, W83-00033 2H

**LEBOEUF, R. J.**  
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation—Part III, W83-00259 3A

**LECHIEN, A.**  
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters, W83-00045 5A

**LEE, G. F.**  
Water Quality Standards and Water Quality, W83-00162 5G

**LEE, J. V.**  
The Incidence of *Vibrio Cholerae* in Water, Animals and Birds in Kent, England, W83-00012 5B

## **AUTHOR INDEX**

MILLER, J. F.

|   |    |   |     |  |    |
|---|----|---|-----|--|----|
| <b>LENAT, D. R.</b><br>Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake, W83-00044                                | 2H | Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee, W83-00066  | 5B  | <b>MARRO, C. A.</b><br>Hazardous Waste Technology Transfer Assessment, W83-00276   | 5E |
| Water Quality in Urban Streams—What we can Expect, W83-00144  | 5C | Streamflows and Channels of the Green River Basin, Wyoming, W83-00122   | 4A  | <b>MARSALEK, J.</b><br>Adaptation of the ILLUDAS Model to a Desktop Computer, W83-00081  | 7B |
| <b>LESTER, J. N.</b><br>The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge, W83-00327                           | 5D | <b>LOWHAM, H. W.</b><br>Water Quality Simulation of Wahiawa Reservoir, O'ahu, Hawaii, W83-00281   | 5G  | <b>MAVIS, J. D. JR.</b><br>Water Management in the Oil Shale Industry, W83-00185   | 5D |
| <b>LETTENMAIER, D. P.</b><br>Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study, W83-00229 | 3D | <b>LYLE, W. M.</b><br>Water Saving Techniques, W83-00309  | 3F  | <b>MAVUTI, K. M.</b><br>Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya, W83-00056  | 5B |
| <b>LEWIS, W. M. R.</b><br>The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela, W83-00187                                    | 5B | <b>LYNARD, W. G.</b><br>Management and Control Technology for Urban Stormwater Pollution, W83-00148                                       | 5G  | <b>MCCOOL, D. K.</b><br>Effects of Slope Length and Steepness on Soil Erosion from Rangelands, W83-00099   | 2J |
| <b>LIAO, M. Y.</b><br>Removing Soluble Organic Contaminants by Lime-Softening, W83-00172  | 5F | <b>LYSYJ, I.</b><br>Treatment of Oily Wastewaters from Onshore Operations, W83-00319  | 5D  | <b>MCCRAY, K.</b><br>The Nation's Water, W83-00004   | 6D |
| <b>LIAO, W.</b><br>Structural Characterization of Aquatic Humic Material, W83-00190   | 5C | <b>LYTLE, J. S.</b><br>Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi, W83-00159   | 5C  | The Ogallala—Half Full or Half Empty., W83-00017   | 6D |
| <b>LICO, M. S.</b><br>Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters, W83-00127                                | 2K | <b>LYTLE, T. F.</b><br>Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi, W83-00159   | 5C  | <b>MCCULLOUGH, P. J.</b><br>Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection, W83-00182                              | 5A |
| <b>LIDWIN, R. A.</b><br>Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin, W83-00123                                    | 4A | <b>MAAREN, H.</b><br>Soil Survey of the Experimental Catchments Near Bethlehem, W83-00087   | 4D  | <b>MCHUGH, R.</b><br>West River Gets Innovative Technology, W83-00197  | 5F |
| <b>LINDSAY, B. E.</b><br>Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact, W83-00005                                    | 6B | <b>MACK, F. K.</b><br>Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981, W83-00115       | 7C  | <b>MCTIVOR, C. C.</b><br>The Ecology of the Mangroves of South Florida: A Community Profile, W83-00093   | 6G |
| <b>LINGG, A. J.</b><br>Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover), W83-00252                          | 5G | <b>MADDAUS, W. O.</b><br>Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240     | 6B  | <b>MCKEE, M. E.</b><br>Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates, W83-00246   | 3A |
| <b>LITTERICK, M. R.</b><br>Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya, W83-00056                  | 5B | <b>MAES, L.</b><br>Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System, W83-00024                          | 5G  | <b>MEANS, J. L.</b><br>Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222   | 3A |
| <b>LOBMEYER, D. H.</b><br>Geohydrology of Southwestern Kansas, W83-00059  | 7C | <b>MAHON, K. I.</b><br>Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-00116           | 7C  | <b>MEDINE, A. J.</b><br>Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms, W83-00214   | 5B |
| <b>LOHNES, R. A.</b><br>Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa, W83-00218             | 4D | <b>MAINPRIZE, G.</b><br>Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents, W83-00204 | 5A  | <b>MEIER, M. F.</b><br>Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska, W83-00119   | 2C |
| <b>LONG, L. W.</b><br>Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View, W83-00135                               | 5F | <b>MALES, R. M.</b><br>Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I, W83-00273        | 10D | <b>MERCIER, J. L.</b><br>Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed, W83-00346   | 2D |
| <b>LONSDALE, H. K.</b><br>Development of Composite Hollow Fibers - Phase III, W83-00267   | 3A | Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II, W83-00274                             | 10D | <b>MEYER, V. R.</b><br>Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultra-violet Detection, W83-00202 | 5A |
| <b>LOPP, L. E.</b><br>An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979, W83-00064               | 5B | <b>MARINER, R. H.</b><br>Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington, W83-00112             | 2K  | <b>MEYERS, M.</b><br>Investigations on Cellulose Biodegradation in Activated Sludge Plants, W83-00013  | 5D |
| <b>LOWERY, J. F.</b><br>Installation and Sampling of Observation Wells and Analyses of Water from the Shallow                                       |    |   |     | <b>MILLER, J. F.</b><br>Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222  | 3A |

## AUTHOR INDEX

**MILLER, T. S.**

**MILLER, T. S.**  
Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York, W83-00117

**MUNNICH, K. O.**

Factors Controlling Stable Isotope Composition of European Precipitation, W83-00176

**ODUM, W. E.**

The Ecology of the Mangroves of South Florida: A Community Profile, W83-00093

6G

**MILLER, W. J.**

Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240

**MURPHY, K. J.**

The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion, W83-00343

**OLMSTED, F. H.**

Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment, W83-00323

2K

**MILLINGTON, D. S.**

Structural Characterization of Aquatic Humic Material, W83-00190

**NAJJAR, G.**

Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed, W83-00346

**OLSSON, H.**

The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada, W83-00060

4B

**MILLS, K. M.**

Rapid-Mix Design for Mechanisms of Alum Coagulation, W83-00170

**NAKAJIMA, T.**

Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments, W83-00018

**OMANG, R. J.**

Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981, W83-00071

2E

**MITCHELL, M. J.**

Effects of the Burrowing Mayfly, *Hexagenia*, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms, W83-00030

**NAYLOR, D. V.**

Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover), W83-00252

**OMAR, M.**

Preconcentration of Environmental Tin and its Determination Using Catechol Violet, W83-00348

5A

**MIX, M. C.**

Polymeric Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalve Molluscs from Oregon Estuaries, W83-00295

**NEELY, R. K.**

The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh, W83-00266

**OPDYCKE, J. D.**

Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates, W83-00246

3A

**MOESLUND, B.**

Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers, W83-00051

**NEILSON, G. A.**

Soil Maps of Montana, W83-00237

**ORLOB, G. T.**

An Alternative to the Peripheral Canal, W83-00193

6G

**MOHLER, E. H. JR.**

Low Flow of Streams in Fairfax County, Virginia, W83-00062

**NEWBRY, B. W.**

Water Quality Standards and Water Quality, W83-00162

**ORR, B. R.**

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico, W83-00078

7C

**MOORE, J. W.**

Seasonal Abundance of *Ceratium Hirundinella*, (O.F. Müller) Schrank in Lakes of Different Trophy, W83-00052

**NICHOLS, D. S.**

Nutrient Removal From Wastewater by Wetlands, W83-00226

**OSTERKAMP, W. R.**

Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin, W83-00121

4D

**MOORE, R. B.**

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-00116

**NIEHAUS, M. H.**

Conservation Through Crops Research, W83-00311

**OWENS, E. L.**

High-Quality Trickling Filter Effluent Without Tertiary Treatment, W83-00142

5D

**MOORE, S. F.**

Water Quality Simulation of Wahiawa Reservoir, O'ahu, Hawaii, W83-00281

**NIESSLBECK, P.**

Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake, W83-00315

**PALMER, R. N.**

Reservoir Management in Potomac River Basin, W83-00203

6A

**MOOSBURNER, O.**

Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada, W83-00070

**NIXON, S. W.**

Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters, W83-00263

**PANWALKAR, S. S.**

Incentives for Irrigation Water Conservation in Agriculture, W83-00278

3F

**MORAITOU-APOSTOLOPOULOU, M.**

Impact of Chromium to the Population Dynamics of *Tisbe Holothuriæ*, W83-00043

**NOGRADY, T.**

Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage, W83-00023

**PARKER, D. S.**

High-Quality Trickling Filter Effluent Without Tertiary Treatment, W83-00142

5D

**MORAN, S. R.**

Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota, W83-00236

**NORRIS, D. P.**

High-Quality Trickling Filter Effluent Without Tertiary Treatment, W83-00142

**PARKER, R. S.**

Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado, W83-00124

5A

**MORTATTI, J.**

Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis, W83-00194

**NURNBERG, H. W.**

Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters, W83-00045

**PARKER, W. S.**

Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee, W83-00066

5B

**MUELLER, D. K.**

Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs, W83-00009

**O'DONNELL, T. H.**

Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida, W83-00114

**PARRETT, C.**

Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981, W83-00071

2E

**MULHOLLAND, P. J.**

Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data, W83-00174

**O'TOOLE, J.**

Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land, W83-00264

**PARKS, W. S.**

Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado, W83-00124

5A

## AUTHOR INDEX

ROYBAL, R. G.

|  |    |  |  |  |  |  |  |
|--|----|--|--|--|--|--|--|
| PATNI, N. J.   |    |  |  |  |  |  |  |
| The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret, W83-00333   | 5C |  |  |  |  |  |  |
| PATRIARCHE, G. J.  |    |  |  |  |  |  |  |
| Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters, W83-00045                  | 5A |  |  |  |  |  |  |
| PEARCY, R. W.  |    |  |  |  |  |  |  |
| Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral, W83-00307   | 2I |  |  |  |  |  |  |
| PEARSON, W. R.   |    |  |  |  |  |  |  |
| High Plains - Ogallala Aquifer Study Water Transfer Element, W83-00312   | 4A |  |  |  |  |  |  |
| PENROSE, D. L.   |    |  |  |  |  |  |  |
| Water Quality in Urban Streams--What we can Expect, W83-00144  | 5C |  |  |  |  |  |  |
| PEREIRA, W. E.   |    |  |  |  |  |  |  |
| Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption, W83-00161   | 5A |  |  |  |  |  |  |
| PESSENDIA, L. C. R.  |    |  |  |  |  |  |  |
| Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis, W83-00194  | 5A |  |  |  |  |  |  |
| PHILLIPS, C. B.  |    |  |  |  |  |  |  |
| Estimating Hydrologic Values for Planning Wildland Fire Protection, W83-00306  | 6B |  |  |  |  |  |  |
| PIETERSE, A. J. H.   |    |  |  |  |  |  |  |
| Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation, W83-00284   | 5D |  |  |  |  |  |  |
| PIRBAZARI, M.  |    |  |  |  |  |  |  |
| Adsorption of Toxic and Carcinogenic Compounds from Water, W83-00171   | 5F |  |  |  |  |  |  |
| PITMAN, W. V.  |    |  |  |  |  |  |  |
| A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia, W83-00289  | 2B |  |  |  |  |  |  |
| POSTON, T. M.  |    |  |  |  |  |  |  |
| Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout ( <i>Salmo Gairdneri</i> ), W83-00021  | 5C |  |  |  |  |  |  |
| POWELL, T. M.  |    |  |  |  |  |  |  |
| In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light, W83-00141   | 5C |  |  |  |  |  |  |
| PREPAS, E. E.  |    |  |  |  |  |  |  |
| Improvements in Quantifying the Phosphorus Concentration in Lake Water, W83-00208  | 5C |  |  |  |  |  |  |
| PRESSER, T. S.   |    |  |  |  |  |  |  |
| Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington, W83-00112   | 2K |  |  |  |  |  |  |
| PRETORIUS, J.  |    |  |  |  |  |  |  |
| The Occurrence of a Fungal Parasite on a <i>Tetraselmis</i> ( <i>Prasinophyceae</i> ) Species, W83-00288   | 5C |  |  |  |  |  |  |
| PROBSTEIN, R. F.   |    |  |  |  |  |  |  |
| Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems, W83-00244  | 3A |  |  |  |  |  |  |
| PROMNITZ, L. C.  |    |  |  |  |  |  |  |
| Dendrography for Optimal Water and Energy Utilization in Plant Growth, W83-00265   | 3F |  |  |  |  |  |  |
| PULJKER, L. M.   |    |  |  |  |  |  |  |
| Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis, W83-00046   | 5A |  |  |  |  |  |  |
| QASIM, S. R.   |    |  |  |  |  |  |  |
| Effect of a Bacterial Culture Product on Biological Kinetics, W83-00212  | 5D |  |  |  |  |  |  |
| RAMASAMY, K.   |    |  |  |  |  |  |  |
| Investigations on Cellulose Biodegradation in Activated Sludge Plants, W83-00013   | 5D |  |  |  |  |  |  |
| RANDTKE, S. J.   |    |  |  |  |  |  |  |
| New Technology for Drinking Water Treatment, W83-00198   | 5F |  |  |  |  |  |  |
| Removing Soluble Organic Contaminants by Lime-Softening, W83-00172   | 5F |  |  |  |  |  |  |
| RANZAU, C. E. JR.  |    |  |  |  |  |  |  |
| Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas, W83-00075 | 7C |  |  |  |  |  |  |
| RAO, P. K.   |    |  |  |  |  |  |  |
| Policy Objectives and Information System for Irrigation Projects-India, W83-00011  | 6A |  |  |  |  |  |  |
| RASMUSSEN, L. A.   |    |  |  |  |  |  |  |
| Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska, W83-00119  | 2C |  |  |  |  |  |  |
| REAVELL, P. E.   |    |  |  |  |  |  |  |
| The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance, W83-00036   | 2H |  |  |  |  |  |  |
| REES, T. F.  |    |  |  |  |  |  |  |
| Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant, W83-00019  | 5B |  |  |  |  |  |  |
| REFLING, D. R.   |    |  |  |  |  |  |  |
| Advanced Biological Treatment to Achieve Nutrient Removal, W83-00349   | 5D |  |  |  |  |  |  |
| RENARD, K. G.  |    |  |  |  |  |  |  |
| Sediment Yield from Small Semiarid Rangeland Watersheds, W83-00105   | 4D |  |  |  |  |  |  |
| REUST, J. B.   |    |  |  |  |  |  |  |
| Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultraviolet Detection, W83-00202                                 | 5A |  |  |  |  |  |  |
| REVELLE, C. S.   |    |  |  |  |  |  |  |
| Reservoir Management in Potomac River Basin, W83-00203   | 6A |  |  |  |  |  |  |
| RICHERSON, P. J.   |    |  |  |  |  |  |  |
| In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light, W83-00141   | 5C |  |  |  |  |  |  |
| RIEKER, H.   |    |  |  |  |  |  |  |
| Pine Tree Evapotranspiration, W83-00279  | 2D |  |  |  |  |  |  |
| RIGGIN, R. M.  |    |  |  |  |  |  |  |
| Determination of Benzidines in Industrial and Municipal Wastewaters, W83-00292   | 5A |  |  |  |  |  |  |
| ROBERTS, J. W.   |    |  |  |  |  |  |  |
| Floodflow Characteristics Related to Channel Geometry in Ohio, W83-00067   | 2E |  |  |  |  |  |  |
| ROBERTS, R. T.   |    |  |  |  |  |  |  |
| Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973, W83-00095   | 7C |  |  |  |  |  |  |
| ROBINSON, M.   |    |  |  |  |  |  |  |
| The Use of Oxygen to Upgrade the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works, W83-00133                              | 5D |  |  |  |  |  |  |
| ROBINSON, M. J.  |    |  |  |  |  |  |  |
| The Flow of Slurry from a Breached Tailings Dam, W83-00285   | 8B |  |  |  |  |  |  |
| ROBINSON, R. B.  |    |  |  |  |  |  |  |
| Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis, W83-00241   | 6A |  |  |  |  |  |  |
| ROBSON, C. M.  |    |  |  |  |  |  |  |
| Spreading Lagooned Sewage Sludge on Farmland: A Case History, W83-00296  | 5E |  |  |  |  |  |  |
| ROE, E. M.   |    |  |  |  |  |  |  |
| Lake Restoration Technology Transfer Assessment, W83-00215   | 5G |  |  |  |  |  |  |
| ROE, P. C. JR.   |    |  |  |  |  |  |  |
| Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes, W83-00149  | 5D |  |  |  |  |  |  |
| ROMBERG, G. P.   |    |  |  |  |  |  |  |
| Design of Monitoring Studies for Priority Pollutants, W83-00321  | 7A |  |  |  |  |  |  |
| RONEN, M.  |    |  |  |  |  |  |  |
| The Characterization and Processing of Lime Sludges from Water Reclamation Plants, W83-00086   | 5D |  |  |  |  |  |  |
| ROQUES, P. F.  |    |  |  |  |  |  |  |
| Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters, W83-00263   | 5C |  |  |  |  |  |  |
| ROSAIN, R. M.  |    |  |  |  |  |  |  |
| Water Management in the Oil Shale Industry, W83-00185  | 5D |  |  |  |  |  |  |
| ROSSIN, A. C.  |    |  |  |  |  |  |  |
| The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge, W83-00327  | 5D |  |  |  |  |  |  |
| ROSTAD, C. E.  |    |  |  |  |  |  |  |
| Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption, W83-00161   | 5A |  |  |  |  |  |  |
| ROYBAL, R. G.  |    |  |  |  |  |  |  |
| Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico, W83-00078  | 7C |  |  |  |  |  |  |

## AUTHOR INDEX

**ROZANSKI, K.**

**ROZANSKI, K.**  
Factors Controlling Stable Isotope Composition of European Precipitation, W83-00176 2B

**RUHL, J. F.**  
Designation of Principal Water-Supply Aquifers in Minnesota, W83-00125 2F

**RUNKEL, K. H.**  
Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses, W83-00037 2H

**SAHA, S. K.**  
Irrigation Planning in the Tana Basin of Kenya, W83-00015 6B

**SALJO, Y.**  
Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton, W83-00344 2H

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen, W83-00345 2H

Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer, W83-00040 2H

**SAMMIS, E. J.**  
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I, W83-00235 3F

**SAULNIER, G. J. JR.**  
Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado, W83-00168 4C

**SAWHNEY, B. L.**  
Multiple Purge Techniques for Determining Organic Pollutants in Groundwater, W83-00158 5A

**SCHANZ, F.**  
Limnological Investigations of a Mountain Spring Pond in the Swiss National Park, W83-00034 2H

**SCHILLINGER, J. E.**  
Coliform Attachment to Suspended Particles in Stormwater, W83-00224 5B

**SCHOPP, R. D.**  
Low-Flow Characteristics and Flow Duration of New Jersey Streams, W83-00061 7C

**SCHULZ, R. S.**  
Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis, W83-00241 6A

**SCHULZE, R. E.**  
Hydrology and Water Resources of the Drakensberg, W83-00085 4A

The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation, W83-00140 2J

**SCHWAB, B. S.**  
Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water, W83-00211 5B

**SCOTT, A. G.**  
Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia, W83-00128 4A

**SEPERS, A. B. J.**  
The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands), W83-00178 5C

**SHARPE, W. E.**  
Hazardous Waste Technology Transfer Assessment, W83-00276 5E

Lake Restoration Technology Transfer Assessment, W83-00215 5G

The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation, W83-00258 5G

**SHAW, R. H.**  
Efficient Use of Water for Irrigation in the Upper Midwest, W83-00242 3F

**SHELTON, W. L.**  
Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II, W83-00272 4A

**SHEN, T. C.**  
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation-Part III, W83-00259 3A

**SHERIDAN, R. P.**  
Municipal Pretreatment Program Development, W83-00350 5D

**SHERWIN, L. S.**  
The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation, W83-00258 5G

**SHILLINGLAW, S. N.**  
Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation, W83-00284 5D

**SHIRLEY, E. D.**  
Modeling Erosion in Overland Flow, W83-00104 4D

**SIKONIA, W. G.**  
Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska, W83-00118 2C

**SILSBEE, D. G.**  
Water Quality of Streams in the Great Smoky Mountains National Park, W83-00032 5B

**SIMANTON, J. R.**  
The USLE Rainfall Factor for Southwestern U. S. Rangelands, W83-00098 4D

**SIMMLER, J. J.**  
Municipal Pretreatment Program Development, W83-00350 5D

**SIMMONS, M. S.**  
Association Studies of Polybrominated Biphenyls in Aquatic Systems, W83-00160 5B

**SINGLEY, M. E.**  
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential, W83-00233 5E

**SINNOTT, A.**  
Summary Appraisals of the Nation's Ground-Water Resources-New England Region, W83-00120 4B

**SLACK, J. R.**  
A Study of Trends in Total Phosphorus Measurements at Nascan Stations, W83-00126 5B

**SLAGLE, S. E.**  
Geohydrology of Southwestern Kansas, W83-00059 7C

**SLAPIK, M. A.**  
Improvements in Foam Flotation for Lead Removal, W83-00150 5D

**SMITH, E. D.**  
Water Characteristics, W83-00169 5B

**SMITH, J. A.**  
Reservoir Management in Potomac River Basin, W83-00203 6A

**SMITH, R. A.**  
A Study of Trends in Total Phosphorus Measurements at Nascan Stations, W83-00126 5B

**SMITH, T. J. III.**  
The Ecology of the Mangroves of South Florida: A Community Profile, W83-00093 6G

**SMITHEN, A. A.**  
The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation, W83-00140 2J

**SMOCK, L. A.**  
Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake, W83-00044 2H

**SMOL, J. P.**  
The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment, W83-00042 5C

**SOMMERS, L. E.**  
Spreading Lagooned Sewage Sludge on Farmland: A Case History, W83-00296 5E

**SONNTAG, C.**  
Factors Controlling Stable Isotope Composition of European Precipitation, W83-00176 2B

**SOREY, M. L.**  
The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada, W83-00060 4B

**SORTLAND, B.**  
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water, W83-00330 5B

**SPANGLER, L. E.**  
Groundwater in the Inner Bluegrass Karst Region, Kentucky, W83-00275 2F

**STEGGALL, J. W.**  
Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake, W83-00227 5C

**STEINBERG, C.**  
Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake, W83-00315 5G

**STELZ, W. G.**  
Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069 7C

## AUTHOR INDEX

VARLEY, R. A.

|  |    |  |    |   |    |
|--|----|--|----|---|----|
| <b>STENSEL, H. D.</b><br>Advanced Biological Treatment to Achieve Nutrient Removal,<br>W83-00349   | 5D | toplankton and Other Particulate Material in a Productive English Lake,<br>W83-00055   | 5C | Stabilizing High-Strength Wastes with Photosynthetic Bacteria,<br>W83-00181   | 5D |
| <b>STEPHENSON, G. R.</b><br>Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),<br>W83-00252   | 5G | TAYLOR, H. E.<br>Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,<br>W83-00161         | 5A | TOMASCHKE, J. E.<br>Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,<br>W83-00246  | 3A |
| <b>STERRETT, R. M.</b><br>The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,<br>W83-00327   | 5D | TAYLOR, M. C.<br>Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,<br>W83-00079  | 5G | TORAK, L. J.<br>Applications of Digital Modeling for Evaluating the Ground-Water Resources of the 2,000-Foot Sand of the Baton Rouge Area, Louisiana,<br>W83-00109                        | 4B |
| <b>STEWART, A. J.</b><br>Phytoplankton Contribution to Alkaline Phosphate Activity,<br>W83-00041   | 2H | TEKIPPE, R. J.<br>Water Quality Criteria and Effluent Requirements in Broward County, Florida,<br>W83-00320  | 5G | TORRES-GONZALEZ, A.<br>Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,<br>W83-00072  | 5B |
| <b>STINEHELFER, M. L.</b><br>Effect of a Bacterial Culture Product on Biological Kinetics,<br>W83-00212  | 5D | THACKSTON, E. L.<br>Improvements in Foam Flotation for Lead Removal,<br>W83-00150  | 5D | TOTH, S. J.<br>Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,<br>W83-00233   | 5E |
| <b>STOLTERBERG, D.</b><br>Digester Control Pays Dividends,<br>W83-00192  | 5D | THIEL, C. E.<br>Removing Soluble Organic Contaminants by Lime-Softening,<br>W83-00172  | 5F | TOWNLEY, J. M.<br>HO: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,<br>W83-00253  | 6B |
| <b>STONE, J. J.</b><br>Sediment Yield from Small Semiarid Rangeland Watersheds,<br>W83-00105   | 4D | THOMAS, C. P.<br>Tracing Well Water Pollution in a Limestone Aquifer,<br>W83-00173   | 5B | TREWEEK, G. P.<br>Water Quality Criteria and Effluent Requirements in Broward County, Florida,<br>W83-00320   | 5G |
| <b>STONEBURNER, D. L.</b><br>Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,<br>W83-00044  | 2H | THOMAS, N. O.<br>Manual for Leveling at Gaging Stations in North Carolina,<br>W83-00065  | 7B | TROESTER, J. W.<br>Groundwater in the Inner Bluegrass Karst Region, Kentucky,<br>W83-00275  | 2F |
| <b>STOREY, D. A.</b><br>Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,<br>W83-00005   | 6B | THOMPSON, J. C.<br>New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,<br>W83-00137   | 5G | TUNTOOLAVEST, M.<br>Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,<br>W83-00179  | 5D |
| <b>STRAUSE, J. L.</b><br>Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,<br>W83-00075 | 7C | THORNTON, J. A.<br>Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,<br>W83-00025  | 5C | TURK, J. T.<br>Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,<br>W83-00124   | 5A |
| <b>SULLIVAN, C. Y.</b><br>Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,<br>W83-00234   | 3F | THORPE, J. W.<br>Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,<br>W83-00204                            | 5A | TWORECK, W. C.<br>Solid Waste Management in South Africa,<br>W83-00090  | 5G |
| <b>SWAN, M. J.</b><br>Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,<br>W83-00177   | 5D | THORSON, N. W.<br>Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,<br>W83-00250                                  | 6E | UHL, V. W. JR.<br>Control Measures for Groundwater VOCs,<br>W83-00199   | 5F |
| <b>SWEENEY, J. J.</b><br>Trade Effluent Control and the Microprocessor,<br>W83-00003   | 5G | THRAILKILL, J.<br>Groundwater in the Inner Bluegrass Karst Region, Kentucky,<br>W83-00275  | 2F | VALENTA, P.<br>Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,<br>W83-00045 | 5A |
| <b>SZEKELY, F.</b><br>Environmental Impact of Large Hydroelectric Projects on Tropical Countries,<br>W83-00010   | 6G | THURMAN, J. L.<br>Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,<br>W83-00095  | 7C | VAN DER GEUGEN, R. P.<br>Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique),<br>W83-00047                                   | 5A |
| <b>TAKAHASHI, M.</b><br>Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,<br>W83-00344  | 2H | THYSSEN, N.<br>Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,<br>W83-00051 | 5B | VAN WYK, D. B.<br>Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,<br>W83-00304                                 | 5B |
| Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,<br>W83-00345   | 2H | TITAMNIS, Z. V.<br>Daily Chemical Variability of Domestic Septic Tank Effluent,<br>W83-00328   | 5D | VANAGEL, M. A.<br>The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,<br>W83-00258  | 5G |
| Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,<br>W83-00040   | 2H | TITTLEBAUM, M. E.<br>Algae Removal by Induced Air Flotation,<br>W83-00277  | 5G | VARLEY, R. A.<br>The Use of Oxygen to Uptake the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,<br>W83-00133            | 5D |
| <b>TALLING, J. F.</b><br>The Development of Attenuation Depth-Profiling to Follow the Changing Distribution of Phy-  |    | TOERIEN, D. F.<br>Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System,<br>W83-00317                  | 5D |   |    |

## AUTHOR INDEX

**VASHON, R. D.**

|   |    |  |    |
|---|----|--|----|
| <b>VASHON, R. D.</b>  |    |  |    |
| Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water, W83-00211 | 5B | WAUTHY, G.   |    |
|   |    | Some Aspects of the Colonization by Water Mites (Acar, Actinedida) of an Artificial Substrate in a Disturbed Environment, W83-00054                            | 5C |
| <b>VAUGHN, C. C.</b>  |    |  |    |
| Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas, W83-00031  | 2H | WAYBRANT, R. C.  |    |
|   |    | Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs, W83-00147  | 5G |
| <b>VEENENDAAL, G.</b>   |    |  |    |
| Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis, W83-00046                          | 5A | WEBBER, E. E.  |    |
|   |    | Floodflow Characteristics Related to Channel Geometry in Ohio, W83-00067   | 2E |
| <b>VERACHTERT, H.</b>   |    |  |    |
| Investigations on Cellulose Biodegradation in Activated Sludge Plants, W83-00013  | 5D | WEBER, W. J. JR.   |    |
|   |    | Adsorption of Toxic and Carcinogenic Compounds from Water, W83-00171   | 5F |
| <b>VERDONSCHOT, P. F. M.</b>  |    |  |    |
| Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands, W83-00035                                   | 2L | WEIBEZAHN, F.  |    |
|   |    | The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela, W83-00187   | 5B |
| <b>VERDUN, J.</b>   |    |  |    |
| Components Contributing to Light Extinction in Natural Water: Method of Isolation, W83-00213  | 5A | WEINTRAUB, M.  |    |
|   |    | Biooxidation of Paint Process Wastewater, W83-00143  | 5D |
| <b>VERRIOPoulos, G.</b>   |    |  |    |
| Impact of Chromium to the Population Dynamics of Tisbe Holothuriae, W83-00043   | 5C | WELCH, A. H.   |    |
|   |    | The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada, W83-00060   | 4B |
| <b>VIGERS, G. A.</b>  |    |  |    |
| Design of Monitoring Studies for Priority Pollutants, W83-00321   | 7A | WELLS, W. G. II  |    |
|   |    | Role of Fungi in Postfire Stabilization of Chaparral Ash Beds, W83-00302   | 4D |
| <b>VIRTANEN, M. T.</b>  |    |  |    |
| The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System, W83-00332   | 5B | WENTZEL, R. S.   |    |
|   |    | Increasing Arcat Test Sensitivity for Examination of Potable Waters, W83-00293   | 5F |
| <b>WAGSTAFF, K.</b>   |    |  |    |
| Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters, W83-00195                | 5A | WESCHIE, T. A.   |    |
|   |    | Instream Salmonid Habitat Exclusion by Ice-Cover, W83-00257  | 8I |
| <b>WALKER, O. L.</b>  |    |  |    |
| Recycling of Mercury and Silver from COD Tests, W83-00145   | 5D | WEST, P. A.  |    |
|   |    | The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England, W83-00012   | 5B |
| <b>WALKER, W. R.</b>  |    |  |    |
| Law, W83-00165  | 6E | WESTERBACK, A. E.  |    |
|   |    | Cathodic Protection of Water Mains, W83-00175  | 8G |
| <b>WALMSLEY, R. D.</b>  |    |  |    |
| Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes, W83-00025   | 5C | WESTERHOFF, G. P.  |    |
|   |    | Control Measures for Groundwater VOCs, W83-00199   | 5F |
| <b>WALTI, K.</b>  |    |  |    |
| Limnological Investigations of a Mountain Spring Pond in the Swiss National Park, W83-00034   | 2H | WETZEL, R. G.  |    |
|   |    | Phytoplankton Contribution to Alkaline Phosphatase Activity, W83-00041   | 2H |
| <b>WARNICK, C. C.</b>   |    |  |    |
| Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis, W83-00251  | 2E | WHALEN, S. C.  |    |
|   |    | Physicochemical Limnology of the Tongue River Reservoir, Montana, W83-00033  | 2H |
| <b>WATT, M. H.</b>  |    |  |    |
| A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management, W83-00247   | 5G | WHEELER, J. C.   |    |
|   |    | Map Showing the Potentiometric Surface of the Magothay Aquifer in Southern Maryland, September 1981, W83-00115   | 7C |
| <b>WATTS, J. A.</b>   |    |  |    |
| Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data, W83-00174                         | 5B | WHEELAN, B. R.   |    |
|   |    | Daily Chemical Variability of Domestic Septic Tank Effluent, W83-00328   | 5D |
|   |    |  |    |
|   |    | WHEELAN, G.  |    |
|   |    | IHHR Distributed Parameter Watershed Model, W83-00269  | 2E |
|   |    |  |    |
|   |    | WHITE, R. R.   |    |
|   |    | Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico, W83-00078  | 7C |
|   |    |  |    |
|   |    | WHITEHEAD, P. G.   |    |
|   |    | Practical Techniques of River Monitoring and Pollution Forecasting, W83-00238  | 5B |
|   |    |  |    |
|   |    | WHITEMAN, C. D. JR.  |    |
|   |    | Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana, W83-00109              | 4B |
|   |    |  |    |
|   |    | WICHERS, D. L.   |    |
|   |    | Instream Salmonid Habitat Exclusion by Ice-Cover, W83-00257  | 8I |
|   |    |  |    |
|   |    | WILLIAMS, J. R.  |    |
|   |    | Testing the Modified Universal Soil Loss Equation, W83-00107   | 4D |
|   |    |  |    |
|   |    | WILSON, C. A.  |    |
|   |    | Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico, W83-00078  | 7C |
|   |    |  |    |
|   |    | WILSON, D. B.  |    |
|   |    | Water Treatment for Small Public Supplies, W83-00280   | 5F |
|   |    |  |    |
|   |    | WILSON, D. J.  |    |
|   |    | Improvements in Foam Flotation for Lead Removal, W83-00150   | 5D |
|   |    |  |    |
|   |    | WILSON, W. E.  |    |
|   |    | Estimated Effects of Projected Ground-Water Withdrawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida, W83-00130 | 4B |
|   |    |  |    |
|   |    | WINTER, S. J.  |    |
|   |    | Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands, W83-00268   | 8C |
|   |    |  |    |
|   |    | WISNIEWSKI, J.   |    |
|   |    | An Overview of Acid Rain Monitoring Activities in North America, W83-00189   | 5C |
|   |    |  |    |
|   |    | WITT, V. M.  |    |
|   |    | Developing and Applying International Water Quality Guidelines, W83-00167  | 5G |
|   |    |  |    |
|   |    | WOHLGEMUTH, P. M.  |    |
|   |    | Role of Fungi in Postfire Stabilization of Chaparral Ash Beds, W83-00302   | 4D |
|   |    |  |    |
|   |    | WOLF, R. J.  |    |
|   |    | Designation of Principal Water-Supply Aquifers in Minnesota, W83-00125   | 2F |
|   |    |  |    |
|   |    | WOOD, WAYNE A.   |    |
|   |    | Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana, W83-00076   | 7C |
|   |    |  |    |
|   |    | WRIGHT, J. C.  |    |
|   |    | Physicochemical Limnology of the Tongue River Reservoir, Montana, W83-00033  | 2H |
|   |    |  |    |
|   |    | WRIGHT, V. A.  |    |
|   |    | Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters, W83-00127   | 2K |
|   |    |  |    |
|   |    | WYANT, T.  |    |
|   |    | Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia, W83-00128  | 4A |
|   |    |  |    |
|   |    | WYNNE, D.  |    |
|   |    | The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret, W83-00333                           | 5C |

**AUTHOR INDEX**

**ZOLAN, W. J.**

**YAMAYA, C. N.**  
Removing Soluble Organic Contaminants by  
Lime-Softening,  
W83-00172 5F

**YASUDA, H.**  
A Study of Glow Discharge Polymerization as a  
Means of Preparing Composite Reverse Osmosis  
Membranes with Ultrathin Skin,  
W83-00260 3A

**YOSHIOKA, T.**  
Nitrogen Metabolism in Lake Kizaki, Japan. III.  
Active Nitrification in Early Summer,  
W83-00040 2H

**YOUNG, D. D.**  
Chemical Surveillance of Rivers,  
W83-00134 5A

**YOUNG, G. P.**  
Water Quality Simulation of Wahiawa Reser-  
voir, O'Ahu, Hawaii,  
W83-00281 5G

**YOUNG, R. H. F.**  
Water Quality Simulation of Wahiawa Reser-  
voir, O'Ahu, Hawaii,  
W83-00281 5G

**ZAGATTO, E. A. G.**  
Determination of Iron in Natural Waters and  
Plant Material with 1,10-Phenanthroline by  
Flow Injection Analysis,  
W83-00194 5A

**ZAISS, U.**  
The Sediments of the New Artificial Lake Bos-  
talsee (Saarland, Germany), with Particular Ref-  
erence to Microbial Activity,  
W83-00048 5C

**ZASUKHIN, V. S.**  
Use of the Water-Salt Balance Method for Cal-  
culating the Desalination Regime of a Large  
Water Body,  
W83-00322 5G

**ZASUKHINA, E. S.**  
Use of the Water-Salt Balance Method for Cal-  
culating the Desalination Regime of a Large  
Water Body,  
W83-00322 5G

**ZIMNY, B. L.**  
Development of Novel Porous Substrates for  
Ultrafiltration, Desalination and Water Reclama-  
tion—Part III,  
W83-00259 3A

**ZOLAN, W. J.**  
A Preliminary Study of Natural Aquifer Dis-  
charge of Guam,  
W83-00271 5B



## ORGANIZATIONAL INDEX

|   |   |    |
|---|---|----|
| <b>AGRICULTURAL RESEARCH CENTER,<br/>BELTSVILLE, MD. HYDROLOGIC DATA<br/>LAB.</b>   | Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973, W83-00095  | 7C |
| <b>AGRICULTURAL RESEARCH SERVICE,<br/>BELTSVILLE, MD. HYDROLOGY LAB.</b>  | Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States, W83-00347   | 2A |
| <b>AGRICULTURAL RESEARCH SERVICE,<br/>TEMPLE, TX.</b>   | Testing the Modified Universal Soil Loss Equation, W83-00107  | 4D |
| <b>ALASKA UNIV., FAIRBANKS, INST. OF<br/>MARINE SCIENCE.</b>  | Physicochemical Limnology of the Tongue River Reservoir, Montana, W83-00033   | 2H |
| <b>ALBERTA ENVIRONMENTAL CENTER,<br/>VEGREVILLE.</b>  | Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography, W83-00014  | 5A |
|   | Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy, W83-00052  | 5C |
| <b>ALBERTA RESEARCH COUNCIL,<br/>EDMONTON, GEOLOGY DIV.</b>   | Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota, W83-00236  | 5E |
| <b>ALBERTA UNIV., EDMONTON, DEPT. OF<br/>BOTANY.</b>  | Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy), W83-00316                                  | 2H |
| <b>ALBERTA UNIV., EDMONTON, DEPT. OF<br/>CIVIL ENGINEERING.</b>   | Water Reclamation and Reuse, W83-00163  | 5D |
| <b>ALBERTA UNIV., EDMONTON, DEPT. OF<br/>ZOOLOGY.</b>   | Improvements in Quantifying the Phosphorus Concentration in Lake Water, W83-00208   | 5C |
| <b>ANDERSON-NICHOLS AND CO., INC.,<br/>BOSTON, MA.</b>  | Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View, W83-00135   | 5F |
| <b>ANGLIAN WATER AUTHORITY (ENGLAND).<br/>LINCOLN SEWAGE DIV.</b>   | Trade Effluent Control and the Microprocessor, W83-00003  | 5G |
| <b>ANTWERP UNIV., WILRIJK (BELGIUM).</b>  | Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System, W83-00024   | 5G |
| <b>ARIZONA STATE UNIV., TEMPE, DIV. OF<br/>AGRICULTURE NATURAL RESOURCE<br/>MANAGEMENT.</b>   | Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona, W83-00301                                 | 4D |
| <b>ARIZONA UNIV. TUCSON, DEPT. OF<br/>HYDROLOGY AND WATER RESOURCES.</b>  | The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands, W83-00223       | 6G |
| <b>ARIZONA UNIV., TUCSON, OFFICE OF<br/>ARID LANDS STUDIES.</b>   | Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation, W83-00230  | 3F |
| <b>ARMY ENGINEER DISTRICT, PORTLAND,<br/>OR.</b>  | Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings, W83-00026                       | 5C |
| <b>ARMY ENGINEER WATERWAYS<br/>EXPERIMENT STATION, VICKSBURG, MS.<br/>ENVIRONMENTAL LAB.</b>  | Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques, W83-00006  | 5C |
| <b>ATHENS UNIV. (GREECE). ZOOLOGICAL<br/>LAB. AND MUSEUM.</b>   | Impact of Chromium to the Population Dynamics of Tisbe Holothuriae, W83-00043   | 5C |
| <b>ATLANTIC RESEARCH CORP.,<br/>ALEXANDRIA, VA.</b>   | Increasing Arcat Test Sensitivity for Examination of Potable Waters, W83-00293  | 5F |
| <b>ATOMIC ENERGY OF CANADA LTD.<br/>CHALK RIVER (ONTARIO). CHALK RIVER<br/>NUCLEAR LAB.</b>   | Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents, W83-00204   | 5A |
| <b>AUBURN UNIV., AL. DEPT. OF FISHERIES<br/>AND ALLIED AQUACULTURES.</b>  | Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II, W83-00272   | 4A |
| <b>BATTELLE COLUMBUS LAB., OH.</b>  | Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators, W83-00222   | 3A |
| <b>BATTELLE COLUMBUS LABS., OH.</b>   | Determination of Benzidines in Industrial and Municipal Wastewaters, W83-00292  | 5A |
| <b>BAYERISCHES LANDESAMT FUER<br/>WASSERWIRTSCHAFT, MUNCHEN<br/>(GERMANY, F.R.).</b>  | Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake, W83-00315  | 5G |
| <b>BEND RESEARCH, INC., OR.</b>   | Development of Composite Hollow Fibers - Phase III, W83-00267   | 3A |
| <b>BERNE UNIV. (SWITZERLAND). INST. FOR<br/>INORGANIC, ANALYTICAL AND PHYSICAL<br/>CHEMISTRY.</b>   | Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultra-violet Detection, W83-00202 | 5A |
| <b>BROWN AND CALDWELL, EUGENE, OR.<br/>High-Quality Trickling Filter Effluent Without<br/>Tertiary Treatment, W83-00142</b>                               |   | 5D |
| <b>BROWN AND CALDWELL, PASADENA, CA.<br/>Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management, W83-00240</b> |   | 6B |
| <b>BROWN AND CALDWELL, WALNUT CREEK,<br/>CA.</b>  | Municipal Pretreatment Program Development, W83-00350   | 5D |
| <b>BUNDESGESUNDHEITSAMT, NEUHERBERG<br/>(GERMANY, F.R.). INST. FUER STRAHLENI<br/>HYGIENE.</b>  | Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms, W83-00183  | 5C |
| <b>BUREAU OF LAND MANAGEMENT, BOISE,<br/>ID.</b>  | Use of Erosion Models on Western Rangelands, W83-00097  | 2J |
| <b>BUREAU OF LAND MANAGEMENT, VERNAL, UT.</b>   | Final Environmental Impact Statement of the White River Dam Project, W83-00297  | 6G |
| <b>BUREAU OF MINES, PITTSBURGH, PA.<br/>PITTSBURGH RESEARCH CENTER.</b>   | Sludge Disposal from Acid Mine Drainage Treatment, W83-00298  | 5E |
| <b>BUREAU OF RECLAMATION, DENVER, CO.<br/>ENGINEERING AND RESEARCH CENTER.</b>  | Plumbline Monitor Interface, W83-00094  | 8G |
| <b>BUREAU OF RECLAMATION, DENVER, CO.<br/>ENGINEERING RESEARCH CENTER.</b>  | Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs, W83-00009   | 5C |
| <b>CALIFORNIA STATE UNIV., NORTHRIDGE,<br/>DEPT. OF GEOGRAPHY.</b>  | Erosion and Sedimentation as Part of the Natural System, W83-00305  | 2J |
| <b>CALIFORNIA UNIV., DAVIS, DEPT. OF<br/>BOTANY.</b>  | Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral, W83-00307                        | 2I |
| <b>CALIFORNIA UNIV., DAVIS, DEPT. OF<br/>CIVIL ENGINEERING.</b>   | An Alternative to the Peripheral Canal, W83-00193   | 6G |
| <b>CAMP, DRESSER, AND MCKEE, INC.,<br/>BOSTON, MA.</b>  | New EPA Sodium and Corrosion Regulations: Their Basis and Impacts, W83-00137  | 5G |
| <b>CANADA CENTRE FRO INLAND WATERS,<br/>BURLINGTON (ONTARIO).</b>   | Adaptation of the ILLUDAS Model to a Desktop Computer, W83-00081  | 7B |
| <b>CAPE TOWN UNIV. (SOUTH AFRICA). DEPT.<br/>OF CHEMICAL ENGINEERING.</b>   | A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters, W83-00138  | 5D |

## ORGANIZATIONAL INDEX

### CENTER FOR DEVELOPMENT RESEARCH, HYDERABAD (INDIA).

#### CENTER FOR DEVELOPMENT RESEARCH, HYDERABAD (INDIA).

Policy Objectives and Information System for Irrigation Projects-India,  
W83-00011

6A

#### CENTER FOR ENVIRONMENTAL STUDIES, LEIDEN (NETHERLANDS).

Phosphate and Wind in a Shallow Lake,  
W83-00184

5B

#### CENTRAL INST. FOR INDUSTRIAL RESEARCH, OSLO (NORWAY).

Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,  
W83-00330

5B

#### CENTRO DI ENERGIA NUCLEAR NA AGRICULTURA, SAO PAULO (BRAZIL).

Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,  
W83-00194

5A

#### CH2M/HILL, BELLEVUE, WA.

Water Management in the Oil Shale Industry,  
W83-00185

5D

#### CHALMERS UNIV. OF TECHNOLOGY, GOETEBORG (SWEDEN). INSTITUTIONEN FOER VATTENBYGANAD.

Estimating Runoff Volumes from Urban Areas,  
W83-00007

4A

#### CHULALONGKORN UNIV., BANGKOK (THAILAND). DEPT. OF SANITARY ENGINEERING.

Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,  
W83-00179

5D

#### CINCINNATI UNIV., OH. DEPT. OF MECHANICAL ENGINEERING.

Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,  
W83-00182

5A

#### CITY ENGINEERING DEPT., CAPE TOWN, SOUTH AFRICA.

Blackheath Water Treatment Plant,  
W83-00283

5F

#### CLARKSON COLL. OF TECHNOLOGY, POTSDAM, NY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.

An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,  
W83-00245

5G

#### CLEMSON UNIV., SC. DEPT. OF MICROBIOLOGY.

Aerobic Degradation of Diuron by Aquatic Microorganisms,  
W83-00002

5B

#### COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.

Water Quality Standards and Water Quality,  
W83-00162

5G

#### COLORADO UNIV., BOULDER. DEPT. OF ENVIRONMENTAL, POPULATION AND ORGANISMIC.

The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,  
W83-00187

5B

#### COLUMBIA NATIONAL FISHERY RESEARCH LAB., MD.

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,  
W83-00331

5C

#### COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, WEMBLEY (AUSTRALIA). DIV. OF LAND RESOURCES MANAGEMENT.

Daily Chemical Variability of Domestic Septic Tank Effluent,  
W83-00328

5D

#### COMPAGNIE GENERALE DES EAUX, PARIS (FRANCE).

A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation,  
W83-00205

8G

#### CONCORDIA UNIV., MONTREAL (QUEBEC).

Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,  
W83-00023

5G

#### CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN.

Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,  
W83-00158

5A

#### CONNECTICUT UNIV., STORRS. DEPT. OF CIVIL ENGINEERING.

Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,  
W83-00214

5B

#### CONNECTICUT UNIV., STORRS. INST. OF WATER RESOURCES.

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,  
W83-00231

5A

#### CONSTRUCTION ENGINEERING RESEARCH LAB. (ARMY), CHAMPAIGN, IL.

Water Characteristics,  
W83-00169

5B

#### CORPS OF ENGINEERS, DALLAS, TX. SOUTHWESTERN DIV.

High Plains - Ogallala Aquifer Study Water Transfer Element,  
W83-00312

4A

#### DALHOUSIE UNIV., HALIFAX. DEPT. OF BIOLOGY.

Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment,  
W83-00323

2K

#### DAYTON UNIV., OH. DEPT. OF MICROBIOLOGY.

Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,  
W83-00219

5B

#### DELAWARE UNIV., NEWARK. WATER RESOURCES CENTER.

Cause of Inefficient Solids Separation in the Activated Sludge Process,  
W83-00232

5D

#### DELTA INST. FOR HYDROBIOLOGICAL RESEARCH, YERSEKE (NETHERLANDS).

The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands),  
W83-00178

5C

#### DEPARTMENT OF AGRICULTURE AND FISHERIES, PIETERMARITZBURG (SOUTH AFRICA).

The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation,  
W83-00140

2J

#### DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, TAUPO (NEW ZEALAND). FRESHWATER SECTION.

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,  
W83-00053

5C

#### DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO).

Textile Industry Wastewater Treatment by Air Flotation,  
W83-00080

5D

#### DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). INLAND WATERS DIRECTORATE.

Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,  
W83-00079

5G

#### DEPARTMENT OF WATER AFFAIRS, PRETORIA (SOUTH AFRICA). DIV. OF HYDROLOGY.

The Analyses of Areal Rainfall Using Multi-Quadratic Surfaces,  
W83-00088

2B

#### DEPARTMENT OF WATER AFFAIRS, PRETORIA (SOUTH AFRICA).

The Statistics of Extreme Values and the Analysis of Floods in South Africa,  
W83-00089

2E

#### DEPARTMENT OF WATER AFFAIRS, PRETORIA (SOUTH AFRICA); HYDROLOGICAL RESEARCH INST., PRETORIA (SOUTH AFRICA).

The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,  
W83-00084

2B

#### SOIL SURVEY OF THE EXPERIMENTAL CATCHMENTS NEAR BETHLEHEM,

W83-00087

4D

#### DISTRICT OF COLUMBIA UNIV., WASHINGTON. WATER RESOURCES RESEARCH CENTER.

A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,  
W83-00247

5G

#### DOW CHEMICAL CO., TULSA, OK. DOWELL DIV.

Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,  
W83-00177

5D

#### E.V.S. CONSULTANTS, LTD., VANCOUVER (BRITISH COLUMBIA).

Design of Monitoring Studies for Priority Pollutants,  
W83-00321

7A

#### EAST BAY MUNICIPAL UTILITY DISTRICT, OAKLAND, CA.

Cathodic Protection of Water Mains,  
W83-00175

8G

#### ENGINEERING TECHNOLOGY, INC., NEW ORLEANS, LA.

Tracing Well Water Pollution in a Limestone Aquifer,  
W83-00173

5B

#### ENVIRONMENTAL RESEARCH LAB., GULF BREEZE, FL.

Poly nuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalve Molluscs from Oregon Estuaries,  
W83-00295

5C

#### FLORIDA UNIV., GAINESVILLE. SCHOOL OF FOREST RESOURCES AND CONSERVATION.

Pine Tree Evapotranspiration,  
W83-00279

2D

#### FLOW GENERAL, INC., MCLEAN, VA.

An Overview of Acid Rain Monitoring Activities in North America,  
W83-00189

5C

## ORGANIZATIONAL INDEX

### GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.

|  |     |
|--|-----|
| <b>FORD MOTOR CO., DEARBORN, MI.</b>   |     |
| <b>CHEMISTRY DEPT.</b>   |     |
| Biooxidation of Paint Process Wastewater, W83-00143  | 5D  |
| <b>FOREST SERVICE, ATLANTA, GA.</b>  |     |
| Developing a USLE Cover-Management Factor Procedure for Forest Conditions, W83-00108   | 4D  |
| <b>FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).</b>   |     |
| The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake, W83-00055                | 5C  |
| <b>GATES (W. E.) AND ASSOCIATES, INC., BATAVIA, OH.</b>  |     |
| Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I, W83-00273  | 10D |
| Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II, W83-00274  | 10D |
| <b>GEOLOGICAL SURVEY, ALBANY, NY.</b>  |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-00116   | 7C  |
| Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York, W83-00117   | 7C  |
| Water Resources Data for New York, Water Year 1981—Volume 3. Western New York. W83-00131   | 7C  |
| <b>GEOLOGICAL SURVEY, ALBANY, NY.</b>  |     |
| <b>WATER RESOURCES DIV.; AND NEW YORK STATE GEOLOGICAL SURVEY/STATE MUSEUM, ALBANY.</b>  |     |
| Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069  | 7C  |
| <b>GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.</b>  |     |
| Water-Resources Investigations of the U.S. Geological Survey in New Mexico, Fiscal Year 1980. W83-00073  | 7A  |
| Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico, W83-00078  | 7C  |
| <b>GEOLOGICAL SURVEY, ANNAPOLIS, MD.</b>   |     |
| <b>WATER RESOURCES DIV.; AND GEOLOGICAL SURVEY, TOWSON, MD.</b>  |     |
| Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981, W83-00115  | 7C  |
| <b>GEOLOGICAL SURVEY, BATON ROUGE, LA.</b>   |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Water Resources Data, Louisiana, Water Year 1981—Volume 2. Southern Louisiana. W83-00057   | 7C  |
| Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana, W83-00109  | 4B  |
| <b>GEOLOGICAL SURVEY, CARSON CITY, NV.</b>   |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada, W83-00070   | 2E  |
| <b>GEOLOGICAL SURVEY, CARSON CITY, NV.</b>   |     |
| <b>WATER RESOURCES DIV.; AND GEOLOGICAL SURVEY, MENLO PARK, CA.</b>  |     |
| WATER RESOURCES DIV.   |     |
| The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada, W83-00060   | 4B  |
| <b>GEOLOGICAL SURVEY, CHEYENNE, WY.</b>  |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Streamflows and Channels of the Green River Basin, Wyoming, W83-00122  | 4A  |
| <b>GEOLOGICAL SURVEY, COLUMBUS, OH.</b>  |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Floodflow Characteristics Related to Channel Geometry in Ohio, W83-00067   | 2E  |
| <b>GEOLOGICAL SURVEY, DENVER, CO.; AND BUREAU OF RECLAMATION, DENVER, CO. DENVER FEDERAL CENTER.</b>   |     |
| Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption, W83-00161   | 5A  |
| <b>GEOLOGICAL SURVEY, DENVER, CO.</b>  |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing, W83-00111                                     | 4D  |
| <b>GEOLOGICAL SURVEY, FAIRFAX, VA.</b>   |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Low Flow of Streams in Fairfax County, Virginia, W83-00062   | 4C  |
| <b>GEOLOGICAL SURVEY, HELENA, MT.</b>  |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981, W83-00071  | 2E  |
| Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980, W83-00074   | 7C  |
| Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana, W83-00076   | 7C  |
| <b>GEOLOGICAL SURVEY, HOUSTON, TX.</b>   |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas, W83-00075 | 7C  |
| <b>GEOLOGICAL SURVEY, LAKWOOD, CO.</b>   |     |
| Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant, W83-00019  | 5B  |
| <b>GEOLOGICAL SURVEY, LAKWOOD, CO.</b>   |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado, W83-00077  | 7C  |
| Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado, W83-00124  | 5A  |
| <b>GEOLOGICAL SURVEY, LAWRENCE, KS.</b>  |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Geohydrology of Southwestern Kansas, W83-00059   | 7C  |
| Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin, W83-00121   | 4D  |
| <b>GEOLOGICAL SURVEY, LITTLE ROCK, AR.</b>   |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas—Oklahoma, 1980 Water Year, W83-00063   | 4A  |
| <b>GEOLOGICAL SURVEY, MADISON, WI.</b>   |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin, W83-00123   | 4A  |
| <b>GEOLOGICAL SURVEY, MEMPHIS, TN.</b>   |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee, W83-00066                 | 5B  |
| <b>GEOLOGICAL SURVEY, MENLO PARK, CA.</b>  |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979, W83-00064  | 5B  |
| Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington, W83-00112   | 2K  |
| Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters, W83-00127   | 2K  |
| <b>GEOLOGICAL SURVEY, OKLAHOMA CITY, OK. WATER RESOURCES DIV.</b>  |     |
| Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma, W83-00110                         | 7C  |
| <b>GEOLOGICAL SURVEY, RALEIGH, NC.</b>   |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Manual for Leveling at Gaging Stations in North Carolina, W83-00065  | 7B  |
| Water Resources Data for North Carolina, Water Year 1981, W83-00132  | 7C  |
| <b>GEOLOGICAL SURVEY, RESTON, VA.</b>  |     |
| U.S. Geological Survey Federal-State Program, W83-00201  | 6E  |
| <b>GEOLOGICAL SURVEY, RESTON, VA.</b>  |     |
| <b>WATER RESOURCES DIV.</b>  |     |
| Summary Appraisals of the Nation's Ground-Water Resources—New England Region, W83-00120  | 4B  |
| A Study of Trends in Total Phosphorus Measurements at Nascan Stations, W83-00126   | 5B  |

## ORGANIZATIONAL INDEX

### GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.

|   |    |   |    |  |    |
|---|----|---|----|--|----|
| Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,<br>W83-00128  | 4A | GULF COAST RESEARCH LAB., OCEAN SPRINGS, MS. DEPT. OF ANALYTICAL CHEMISTRY.<br>Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,<br>W83-00159  | 5C | INSTITUTE OF OCEAN SCIENCES, SIDNEY (AUSTRALIA).<br>In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,<br>W83-00141  | 5C |
| <b>GEOLOGICAL SURVEY, SAN JUAN, PR. WATER RESOURCES DIV.</b><br>Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,<br>W83-00072                                   | 5B | <b>GULF SOUTH RESEARCH INST., NEW ORLEANS, LA.</b><br>Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation—Part III,<br>W83-00259                               | 3A | <b>INSTITUTO NACIONAL DE LIMNOLOGIA, SANTO TOME (ARGENTINA).</b><br>A Principal Components Analysis of the Phytoplankton from a Pond in the Paraná River Valley, Argentina,<br>W83-00022   | 5C |
| <b>GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.</b><br>Designation of Principal Water-Supply Aquifers in Minnesota,<br>W83-00125   | 2F | <b>HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER.</b><br>Water Quality Simulation of Wahiawa Reservoir, O'ahu, Hawaii,<br>W83-00281   | 5G | <b>INTERNATIONAL INST. FOR APPLIED SYSTEMS ANALYSIS, LAXENBURG (AUSTRIA).</b><br>The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,<br>W83-00016  | 6A |
| <b>GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.</b><br>Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,<br>W83-00118                             | 2C | <b>HEIDELBERG UNIV. (GERMANY, F.R.). INST. OF ENVIRONMENTAL PHYSICS.</b><br>Factors Controlling Stable Isotope Composition of European Precipitation,<br>W83-00176  | 2B | <b>IOWA STATE UNIV., AMES.</b><br>Dendrography for Optimal Water and Energy Utilization in Plant Growth,<br>W83-00265  | 3F |
| Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,<br>W83-00119  | 2C | <b>HINSDALE SANITARY DISTRICT, IL.</b><br>Digester Control Pays Dividends,<br>W83-00192   | 5D | <b>IOWA STATE UNIV., AMES. DEPT. OF BOTANY.</b><br>The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,<br>W83-00266   | 5G |
| <b>GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.</b><br>Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,<br>W83-00068 | 5B | <b>HYDROLOGICAL RESEARCH INST., PRETORIA (SOUTH AFRICA).</b><br>The Chemical Composition of Water and the Analytical Chemist: A Challenge,<br>W83-00290   | 5A | <b>IOWA STATE UNIV., AMES. DEPT. OF CIVIL ENGINEERING.</b><br>Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,<br>W83-00218   | 4D |
| Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980,<br>W83-00113   | 7C | <b>IBM CORP., HOUSTON, TX.</b><br>Improvements in Foam Flotation for Lead Removal,<br>W83-00150   | 5D | <b>RURAL WATER SUPPLY SYSTEMS: IMPROVED PLANNING STRATEGIES THROUGH SYSTEMS ANALYSIS,</b><br>W83-00241   | 6A |
| Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,<br>W83-00114  | 4B | <b>IDAHO UNIV., MOSCOW. COLL. OF ENGINEERING.</b><br>Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),<br>W83-00252   | 5G | <b>IOWA STATE WATER RESOURCES RESEARCH INST., AMES.</b><br>Efficient Use of Water for Irrigation in the Upper Midwest,<br>W83-00242  | 3F |
| Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,<br>W83-00129   | 5B | <b>IDAHO UNIV., MOSCOW. DEPT. OF CIVIL ENGINEERING.</b><br>Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,<br>W83-00251  | 2E | <b>NITRATE MOVEMENT AND DENITRIFICATION DEFINED RELATIVE TO BROMIDE TRACER IN TILE-DRAINED LAND,</b><br>W83-00264  | 5B |
| <b>GEOLOGICAL SURVEY, TOWSON, MD. WATER RESOURCES DIV.</b><br>Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data.<br>W83-00058      | 7C | <b>ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.</b><br>Removing Soluble Organic Contaminants by Lime-Softening,<br>W83-00172   | 5F | <b>IOWA UNIV., IOWA CITY. DEPT. OF CIVIL ENVIRONMENTAL ENGINEERING.</b><br>High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,<br>W83-00243   | 5D |
| <b>GEOLOGICAL SURVEY, TRENTON, NJ. WATER RESOURCES DIV.</b><br>Low-Flow Characteristics and Flow Duration of New Jersey Streams,<br>W83-00061                                     | 7C | <b>ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF ENVIRONMENTAL ENGINEERING.</b><br>New Technology for Drinking Water Treatment,<br>W83-00198   | 5F | <b>IOWA UNIV., IOWA CITY. INST. OF HYDRAULIC RESEARCH.</b><br>Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short- and Long-Term Information in Real Time,<br>W83-00248   | 4A |
| <b>GEORGIA UNIV., ATHENS. DEPT. OF MATHEMATICS.</b><br>Persistence in Model Ecosystems,<br>W83-00294  | 5B | <b>IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). PUBLIC HEALTH ENGINEERING LAB.</b><br>The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,<br>W83-00327 | 5D | <b>IOWA UNIV., IOWA CITY. IOWA INST. OF HYDRAULIC RESEARCH.</b><br>IHR Distributed Parameter Watershed Model,<br>W83-00269   | 2E |
| <b>GREAT SMOKY MOUNTAINS NATIONAL PARK, GATLINBURG, TN. UPLANDS FIELD RESEARCH LAB.</b><br>Water Quality of Streams in the Great Smoky Mountains National Park,<br>W83-00032      | 5B | <b>INSTITUTE FOR LAND AND WATER MANAGEMENT RESEARCH, WAGENINGEN (THE NETHERLANDS).</b><br>Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips,<br>W83-00326                        | 5D | <b>ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LTD., TIBERIAS; AND KINNERET LIMNOLOGY LAB., TIBERIAS (ISRAEL).</b><br>The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,<br>W83-00333 | 5C |
| <b>GUAM UNIV., AGANA. WATER AND ENERGY RESEARCH INST. OF THE WESTERN PACIFIC.</b><br>Remote Sensing of Water Resources on Pacific Islands,<br>W83-00262                           | 7C | <b>INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).</b><br>Practical Techniques of River Monitoring and Pollution Forecasting,<br>W83-00238   | 5B | <b>JOHNSON SCREENS EUROPE OFFICE, LONDON (ENGLAND).</b><br>Groundwater is the Answer to Zambia's Water Problem,<br>W83-00225   | 4B |
| Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,<br>W83-00268   | 8C |   |    |  |    |
| A Preliminary Study of Natural Aquifer Discharge of Guam,<br>W83-00271  | 5B |   |    |  |    |

## ORGANIZATIONAL INDEX

### NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).

|  |   |  |
|--|---|--|
| JONKERSHOEK FOREST RESEARCH STATION, STELLENBOSCH (SOUTH AFRICA).  | LOUVAIN UNIV. (BELGIUM). LAB. OF GENERAL AND EXPERIMENTAL ECOLOGY.  | MICHIGAN UNIV., ANN ARBOR. DEPT. OF ENVIRONMENTAL AND INDUSTRIAL HEALTH.   |
| Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa, W83-00304   | Some Aspects of the Colonization by Water Mites (Acaria, Actinedida) of an Artificial Substrate in a Disturbed Environment, W83-00054 | Association Studies of Polybrominated Biphenyls in Aquatic Systems, W83-00160  |
| 5B   | 5C  | 5B   |
| JYVASKYLA UNIV. (FINLAND). DEPT. OF CELL BIOLOGY.  | LOUVAIN UNIV. (BELGIUM). LAB. OF INDUSTRIAL MICROBIOLOGY AND BIOCHEMISTRY.  | MICHIGAN UNIV., ANN ARBOR. SCHOOL OF PUBLIC HEALTH.  |
| The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System, W83-00332  | Investigations on Cellulose Biodegradation in Activated Sludge Plants, W83-00013  | Coliform Attachment to Suspended Particles in Stormwater, W83-00224  |
| 5B   | 5D  | 5B   |
| KENT STATE UNIV., OH. DEPT. OF BIOLOGICAL SCIENCES.  | MAJ AND TOR NESSLING FOUNDATION, HELSINKI (FINLAND).  | MICHIGAN UNIV., EAST LANSING. DEPT. OF ZOOLOGY.  |
| Stratigraphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery, W83-00329  | Dynamics of Phytoplankton in Finnish Lakes, W83-00153   | Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake, W83-00227  |
| 2H   | 5C  | 5C   |
| KENTUCKY WATER RESOURCES RESEARCH INST., LEXINGTON.  | MANVILLE SERVICE CORP., DENVER, CO.   | MILJOSTYRELSEN, SILKEBORG (DENMARK). FRESHWATER LAB.   |
| Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover, W83-00255   | Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis, W83-00270   | Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers, W83-00051 |
| 8I   | 3A  | 5B   |
| Groundwater in the Inner Bluegrass Karst Region, Kentucky, W83-00275   | MARYLAND EASTERN SHORE UNIV., PRINCESS ANNE. DEPT. OF NATURAL SCIENCE.  | MISSOURI UNIV.-ROLLA. DEPT. OF CHEMICAL ENGINEERING.   |
| 2F   | Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems, W83-00324  | A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin, W83-00260            |
| 5G   | 5G  | 3A   |
| KERALA UNIV., TRIVANDRUM (INDIA). DEPT. OF AQUATIC BIOLOGY AND FISHERIES.  | MARYLAND UNIV., COLLEGE PARK. DEPT. OF METEOROLOGY.   | MONTANA STATE UNIV., BOZEMAN. DEPT. OF CIVIL ENGINEERING AND ENGINEERING MECHANICS.  |
| Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India, W83-00027   | Climatic Aspects of Droughts, W83-00188   | Rapid-Mix Design for Mechanisms of Alum Coagulation, W83-00170   |
| 2H   | 3F  | 5F   |
| KERNFORSCHUNGSANLAGE JUELICH G.M.B.H. (GERMANY, F.R.). INST. FUER CHEMIE.  | MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF MECHANICAL ENGINEERING.   | MONTANA STATE UNIV., BOZEMAN. DEPT. OF PLANT AND SOIL SCIENCE.   |
| Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters, W83-00045                | Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems, W83-00244                             | Soil Maps of Montana, W83-00237  |
| 5A   | 3A  | 7C   |
| KERNFORSCHUNGSANLAGE JUELICH (GERMANY, F.R.). INST. FUER BIOTECHNOLOGIE III.   | MASSACHUSETTS UNIV., AMHERST. DEPT. OF FOOD AND RESOURCE ECONOMICS.   | MONTGOMERY (JAMES M.), INC., PASADENA, CA.   |
| Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses, W83-00037   | Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact, W83-00005   | Water Quality Criteria and Effluent Requirements in Broward County, Florida, W83-00320   |
| 2H   | 6B  | 5G   |
| KRAEGER ASSOCIATES, LTD., APTOS, CA.   | MASSACHUSETTS UNIV., AMHERST. SCHOOL OF HEALTH SCIENCES.  | NAGOYA UNIV. (JAPAN). WATER RESEARCH INST.   |
| Social and Political Aspects of Drought, W83-00186   | Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts, W83-00139                               | Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer, W83-00040  |
| 6B   | 5B  | 2H   |
| LEWIS AND CLARK LAW SCHOOL, PORTLAND, OR.  | MEMBRANE SYSTEMS, INC., SAN DIEGO, CA.  | Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton, W83-00344   |
| The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective, W83-00210  | Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates, W83-00246                                     | 2H   |
| 5G   | 3A  | 2H   |
| LIMNOLOGICAL INST., OOSTERZEE (NETHERLANDS). TJEUKEMEER LAB.   | MICHIGAN DEPT. OF NATURAL RESOURCES, LANSING.   | Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen, W83-00345                                    |
| Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands, W83-00039  | Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs, W83-00147   | 2H   |
| 5B   | 5G  | 2H   |
| LIVERPOOL UNIV. (ENGLAND) DEPT. OF BOTANY.   | MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF CROP AND SOIL SCIENCE.   | NAIROBI UNIV. (KENYA). DEPT. OF ZOOLOGY.   |
| The Ecological Effects of 2-Methylthiotaiazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion, W83-00343 | Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields, W83-00228   | Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya, W83-00056  |
| 5C   | 5B  | 5B   |
| LOUISIANA WATER RESOURCES RESEARCH INST., BATON ROUGE.   | MICHIGAN STATE UNIV., EAST LANSING. INST. OF WATER RESEARCH.  | NATAL UNIV., DURBAN (SOUTH AFRICA). DEPT. OF AGRICULTURAL ENGINEERING.   |
| Algae Removal by Induced Air Flotation, W83-00277  | A Cooperative Water Resource Technology Transfer Program, W83-00216   | Hydrology and Water Resources of the Drakensberg, W83-00085  |
| 5G   | 6B  | 4A   |
|  | MICHIGAN UNIV., ANN ARBOR. DEPT. OF ENVIRONMENT AND WATER RESOURCES ENGINEERING.  | NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).  |
|  | Adsorption of Toxic and Carcinogenic Compounds from Water, W83-00171  | The Characterization and Processing of Lime Sludges from Water Reclamation Plants, W83-00086   |
|  | 5F  | 5D   |

## ORGANIZATIONAL INDEX

### NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).

|   |    |  |    |   |    |
|---|----|--|----|---|----|
| Solid Waste Management in South Africa,<br>W83-00090  | 5G | NORTH CENTRAL FOREST EXPERIMENT<br>STATION, GRAND RAPIDS, MN.<br>Nutrient Removal From Wastewater by Wet-<br>lands,<br>W83-00226   | 5D | PHILIP M. BOTCH AND ASSOCIATES,<br>BELLEVUE, WA.<br>Adenosine Triphosphate as a Control Parameter<br>for Activated Sludge Processes,<br>W83-00149   | 5D |
| Simple Control Tests for Operators of Small<br>Wastewater Treatment Plants,<br>W83-00092  | 5D | NORWEGIAN INST. FOR WATER<br>RESEARCH, OSLO (NORWAY).<br>Adsorption of PAH to Aquatic Humus,<br>W83-00038  | 5B | PIRINIE (MALCOLM), INC., WHITE PLAINS,<br>NY.<br>Control Measures for Groundwater VOCs,<br>W83-00199  | 5F |
| Algal Concentration and Species Composition in<br>Experimental Maturation Ponds with Effects of<br>Aeration and Recirculation,<br>W83-00284 | 5D | OAK RIDGE NATIONAL LAB., TN.<br>ENVIRONMENTAL SCIENCES DIV.<br>Phytoplankton Contribution to Alkaline Phos-<br>phatase Activity,<br>W83-00041  | 2H | PRESTON HALL HOSPITAL, MAIDSTONE<br>(ENGLAND). PUBLIC HEALTH LAB.<br>The Incidence of Vibrio Cholerae in Water,<br>Animals and Birds in Kent, England,<br>W83-00012   | 5B |
| NATIONAL INST. FOR WATER RESEARCH,<br>PRETORIA (SOUTH AFRICA). LIMNOLOGY<br>DIV.  |    | Transport of Organic Carbon to the Oceans by<br>Rivers of North America: A Synthesis of Exist-<br>ing Data,<br>W83-00174   | 5B | PRETORIA, SOUTH AFRICA, NATIONAL<br>INST. FOR WATER RESEARCH, PRETORIA<br>(SOUTH AFRICA).<br>Chemical Stability of Water.<br>W83-00091  | 5F |
| Applicability of Phosphorus Budget Models to<br>Southern African Man-Made Lakes,<br>W83-00025   | 5C | OKLAHOMA UNIV., NORMAN, DEPT. OF<br>ZOOLOGY.<br>Distribution of Chironomids in the Littoral Zone<br>of Lake Texoma, Oklahoma and Texas,<br>W83-00031   | 2H | PROCTER AND GAMBLE CO., CINCINNATI,<br>OH. ENVIRONMENTAL SAFETY DEPT.<br>Mineralization of Linear Alcohol Ethoxylates<br>and Linear Alcohol Ethoxy Sulfates at Trace<br>Concentrations in Estuarine Water,<br>W83-00211 | 5B |
| NEBRASKA UNIV.-LINCOLN. COLL. OF<br>LAW.  |    | ORANGE FREE STATE UNIV.,<br>BLOEMFONTEIN (SOUTH AFRICA). INST.<br>FOR ENVIRONMENTAL SCIENCE.<br>Stabilizing High-Strength Wastes with Photo-<br>synthetic Bacteria,<br>W83-00181   | 5D | PROVINCIAL WATER AUTHORITY,<br>ZWOLLE (NETHERLANDS). DEPT. OF<br>WATERSHED MANAGEMENT.<br>Some Notes on the Ecology of Aquatic Oligo-<br>chaetes in the Delta Region of the Netherlands,<br>W83-00035                   | 2L |
| Analysis of Legal and Institutional Arrangements<br>Affecting Water Allocation and Use in<br>Nebraska,<br>W83-00250                         | 6E | ORANGE FREE STATE UNIV.,<br>BLOEMFONTEIN (SOUTH AFRICA). INST.<br>FOR ENVIRONMENTAL SCIENCES.<br>Preliminary Studies on the Treatment of Can-<br>ning Factory Effluent with an Integrated Bacte-<br>rial-Algal-Fish System,<br>W83-00317 | 5D | PURDUE UNIV., LAFAYETTE, IN.<br>Spreading Lagooned Sewage Sludge on Farm-<br>land: A Case History,<br>W83-00296   | 5E |
| NEBRASKA UNIV., LINCOLN. DEPT. OF<br>AGRICULTURAL ENGINEERING.  |    | OTTAWA-CARLETON REGIONAL<br>MUNICIPALITY (ONTARIO). WORKS DEPT.<br>Stormwater Runoff Treatment by Impound-<br>ment: Barrhaven Pilot Study,<br>W83-00083  | 5D | PURDUE UNIV., LAFAYETTE, IN. DEPT. OF<br>AGRICULTURAL ENGINEERING.<br>Relation of USLE Factors to Erosion on Range-<br>land,<br>W83-00096   | 2J |
| Irrigation Scheduling,<br>W83-00310   | 3F | PACIFIC NORTHWEST LAB., RICHLAND,<br>WA. DEPT. OF ECOLOGICAL SCIENCES.<br>Observations on the Bioaccumulation Potential<br>of Thorium and Uranium in Rainbow Trout<br>( <i>Salmo Gairdneri</i> ),<br>W83-00021                           | 5C | Special Problems in the Application of the<br>USLE to Rangelands: C and P Factors,<br>W83-00100   | 2J |
| NEVADA UNIV. SYSTEM, RENO. DESERT<br>RESEARCH INST.   |    | PACIFIC SOUTHWEST FOREST AND RANGE<br>EXPERIMENT STATION, GLEN DORA, CA.<br>Role of Fungi in Postfire Stabilization of Chap-<br>arral Ash Beds,<br>W83-00302   | 4D | Estimating Sediment Yield from Rangeland with<br>CREAMS,<br>W83-00103   | 2J |
| Ho: For Reese River Natural Resources of the<br>Toiyabe-Toquima Highlands, Central Nevada,<br>W83-00253                                     | 6B | PAN AMERICAN HEALTH ORGANIZATION,<br>WASHINGTON, DC.<br>Developing and Applying International Water<br>Quality Guidelines,<br>W83-00167  | 5G | PURDUE UNIV. LAFAYETTE, IN. WATER<br>RESOURCES RESEARCH CENTER.<br>Stochastic Daily Precipitation Modeling and<br>Daily Streamflow Transfer Processes,<br>W83-00282   | 2E |
| NEW HAVEN WATER CO., CT.  |    | PENNSYLVANIA STATE UNIV., UNIVERSITY<br>PARK.<br>Lake Restoration Technology Transfer Assess-<br>ment,<br>W83-00215  | 5G | QUEEN'S UNIV., KINGSTON (ONTARIO).<br>DEPT. OF BIOLOGY.<br>The Recent Histories of Three Canadian Shield<br>Lakes: A Paleolimnological Experiment,<br>W83-00042   | 5C |
| West River Gets Innovative Technology,<br>W83-00197   | 5F | PENNSYLVANIA STATE UNIV., UNIVERSITY<br>PARK, COLL. OF AGRICULTURE.<br>The Laurel Run Acid Mine Drainage Renova-<br>tion Demonstration Facility: An Evaluation,<br>W83-00258   | 5G | RAND AFRIKAANS UNIV., JOHANNESBURG<br>(SOUTH AFRICA). DEPT. OF BOTANY.<br>The Occurrence of a Fungal Parasite on a <i>Tetra-<br/>selminis (Prasinophyceae)</i> Species,<br>W83-00288                                    | 5C |
| NEW MEXICO STATE UNIV., LAS CRUCAS.<br>DEPT. OF AGRICULTURAL ENGINEERING.   |    | PENNSYLVANIA STATE UNIV., UNIVERSITY<br>PARK. INST. FOR RESEARCH ON LAND<br>AND WATER RESOURCES.<br>Hazardous Waste Technology Transfer Assess-<br>ment,<br>W83-00276  | 5E | READING UNIV. (ENGLAND). DEPT. OF<br>CHEMISTRY.<br>Preconcentration of Environmental Tin and its<br>Determination Using Catechol Violet,<br>W83-00348   | 5A |
| Water-Use Production Functions of Selected<br>Agronomic Crops in Northwestern New<br>Mexico, Phase I,<br>W83-00234                          | 3F | PENNSYLVANIA STATE UNIV., UNIVERSITY<br>PARK. INST. FOR RESEARCH ON LAND<br>AND WATER RESOURCES.   |    | REEDY CREEK UTILITIES CO., INC., LAKE<br>BUENA VISTA, FL.<br>Advanced Biological Treatment to Achieve Nu-<br>trient Removal,<br>W83-00349   | 5D |
| NEW MEXICO STATE UNIV., LAS CRUCES.<br>DEPT. OF AGRICULTURAL BUSINESS.  |    |  |    |   |    |
| High Plains-Ogallala Aquifer Study, New<br>Mexico -- Economic Impacts,<br>W83-00308   | 6B |  |    |   |    |
| NEW MEXICO STATE UNIV., LAS CRUCES.<br>DEPT. OF AGRONOMY.   |    |  |    |   |    |
| Conservation Through Crops Research,<br>W83-00311   | 3F |  |    |   |    |
| NEW MEXICO STATE UNIV., LAS CRUCES.<br>DEPT. OF CHEMICAL ENGINEERING.   |    |  |    |   |    |
| Water Treatment for Small Public Supplies,<br>W83-00280   | 5F |  |    |   |    |
| NORTH CAROLINA DEPT. OF NATURAL<br>RESOURCES AND COMMUNITY<br>DEVELOPMENT, RALEIGH. DIV. OF<br>ENVIRONMENTAL MANAGEMENT.                    |    |  |    |   |    |
| Water Quality in Urban Streams--What we can<br>Expect,<br>W83-00144   | 5C |  |    |   |    |
| NORTH CAROLINA UNIV. AT CHAPEL<br>HILL. DEPT. OF ENVIRONMENTAL<br>SCIENCES AND ENGINEERING.   |    |  |    |   |    |
| Structural Characterization of Aquatic Humic<br>Material,<br>W83-00190  | 5C |  |    |   |    |

## ORGANIZATIONAL INDEX

### UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA).

|  |    |   |    |   |
|--|----|---|----|---|
| <b>RHODE ISLAND UNIV., KINGSTON.<br/>SCHOOL OF OCEANOGRAPHY.</b>   |    | <b>SEVERN-TRENT WATER AUTHORITY,<br/>MALVERN (ENGLAND). MALVERN<br/>REGIONAL LAB.</b>   |    | <b>TEXAS AGRICULTURAL EXPERIMENT<br/>STATION, LUBBOCK.</b>  |
| Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,<br>W83-00263  | 5C | Pre-Concentration Technique for Cold-Vapour<br>Atomic-Fluorescence Determination of Mercury<br>in Drinking Waters,<br>W83-00195                             | 5A | Water Saving Techniques,<br>W83-00309   |
| <b>RIJKSINSTITUUT VOOR<br/>DRINKWATERVOORZIENING,<br/>LEIDSCHENDAM (NETHERLANDS).</b>  |    | <b>SOIL AND IRRIGATION RESEARCH INST.<br/>PRETORIA, (SOUTH AFRICA). DEPT. OF<br/>AGRICULTURAL TECHNICAL SERVICES.</b>                                       |    | <b>TEXAS TECH UNIV., LUBBOCK. DEPT. OF<br/>INDUSTRIAL ENGINEERING.</b>  |
| Determination of Boron in River Water with<br>Flameless Atomic Absorption Spectrometry<br>(Graphite Furnace Technique),<br>W83-00047 | 5A | A Weighing Lysimeter Facility at Roodeplaat<br>for Crop Evapotranspiration Studies,<br>W83-00287  | 2D | Incentives for Irrigation Water Conservation in<br>Agriculture,<br>W83-00278  |
| <b>ROCKWELL INTERNATIONAL, NEWBURY<br/>PARK, CA. ENVIRONMENTAL<br/>MONITORING AND SERVICES CENTER.</b>                               |    | <b>SOUTHERN ILLINOIS UNIV. AT<br/>CARBONDALE. DEPT OF BOTANY.</b>   |    | <b>TEXAS UNIV. AT ARLINGTON. DEPT. OF<br/>CIVIL ENGINEERING.</b>  |
| Treatment of Oily Wastewaters from Onshore<br>Operations,<br>W83-00319   | 5D | Components Contributing to Light Extinction in<br>Natural Water: Method of Isolation,<br>W83-00213  | 5A | Effect of a Bacterial Culture Product on Biologi-<br>cal Kinetics,<br>W83-00212   |
| <b>ROCKY MOUNTAIN FOREST AND RANGE<br/>EXPERIMENT STATION, TEMPE, AZ.</b>  |    | <b>SOUTHERN ILLINOIS UNIV. AT<br/>EDWARDSVILLE. ENVIRONMENTAL<br/>RESOURCES TRAINING CENTER.</b>  |    | <b>TEXAS UNIV. AT DALLAS.</b>   |
| Angora Goats for Conversion of Arizona Chap-<br>arral: Early Results,<br>W83-00299   | 3B | Manpower Needs in Wastewater Treatment and<br>Collection Systems for the Years 1980 to 2000,<br>W83-00180   | 5G | Bioassay Technique for Relative Toxicity in<br>Water Pollution Control,<br>W83-00146  |
| Stream Water Nutrient Changes Associated with<br>the Conversion of Arizona Chaparral,<br>W83-00300                                   | 5B | <b>SOUTHERN RESEARCH INST.,<br/>BIRMINGHAM, AL.</b>   |    | <b>TEXAS UNIV. HEALTH SCIENCE CENTER<br/>AT HOUSTON. SCHOOL OF PUBLIC<br/>HEALTH.</b>   |
| Water Yield Changes Resulting from Treatment<br>of Arizona Chaparral,<br>W83-00303   | 3B | Preparation of Thin-Ion-Exchange Membranes<br>with Exceptionally Low Resistances and High<br>Selectivities.<br>W83-00261                                    | 3A | Environmental Impact of Large Hydroelectric<br>Projects on Tropical Countries,<br>W83-00010   |
| <b>RUTGERS-THE STATE UNIV., NEW<br/>BRUNSWICK, NJ. CENTER FOR COASTAL<br/>AND ENVIRONMENTAL STUDIES.</b>                             |    | <b>SRI INTERNATIONAL, MENLO PARK, CA.</b>   |    | <b>THOMAS (FRANK A.) AND ASSOCIATES,<br/>INC., WILLOUGHBY, OH.</b>  |
| Land Application of Municipal Sludge with<br>Regard to Cropping Systems and Pollution Po-<br>tential,<br>W83-00233                   | 5E | Development and Demonstration of a Reverse-<br>Osmosis Energy-Recovery Device,<br>W83-00256   | 3A | Intensive Flow Monitoring—Cost-Effectiveness<br>with a Quality Edge,<br>W83-00200   |
| <b>SANTA CLARA UNIV., CA. DEPT. OF CIVIL<br/>ENGINEERING.</b>  |    | <b>STANLEY ASSOCIATES ENGINEERING<br/>LTD., EDMO EDMONTON (ALBERTA); AND<br/>DEARBORN ENVIRONMENTAL<br/>CONSULTING SERVICES, MISSISSAUGA<br/>(ONTARIO).</b> |    | <b>5G</b>   |
| Management and Control Technology for Urban<br>Stormwater Pollution,<br>W83-00148  | 5G | Water and Waste Management in the Canadian<br>Meat and Poultry Processing Industry.<br>W83-00082  | 3E | <b>TOKYO METROPOLITAN UNIV. (JAPAN).<br/>DEPT. OF BIOLOGY.</b>  |
| <b>SCIENCE AND EDUCATION<br/>ADMINISTRATION, AMES, IA.</b>   |    | <b>STATE UNIV. OF NEW YORK COLL. OF<br/>ENVIRONMENTAL SCIENCE AND<br/>FORESTRY, SYRACUSE. DEPT. OF<br/>ENVIRONMENTAL AND FOREST BIOLOGY.</b>                |    | Distribution of Denitrifying Bacteria and its<br>Controlling Factors in Freshwater Environ-<br>ments,<br>W83-00018                              |
| Use of Rainfall Simulators to Determine Param-<br>eters for Erosion Prediction,<br>W83-00102   | 2J | Effects of the Burrowing Mayfly, Hexagenia, on<br>Nitrogen and Sulfur Fractions in Lake Sediment<br>Microcosms,<br>W83-00030                                | 5C | <b>5C</b>   |
| <b>SCIENCE AND EDUCATION<br/>ADMINISTRATION, BOISE, ID.<br/>NORTHWEST WATERSHED RESEARCH<br/>CENTER.</b>                             |    | <b>STELLENBOSCH UNIV. (SOUTH AFRICA).<br/>ADJUSTMENT OF SOIL LIMITATIONS,</b>   |    | <b>TRW, LAKWOOD, COLORADO, ENERGY<br/>ENGINEERING DIVISION.</b>   |
| Predicting Sediment Yields from Sagebrush<br>Rangelands,<br>W83-00106  | 4D | W83-00286   | 2G | Use of Mathematical Models to Predict Impacts<br>of Mining Energy Minerals on the Hydrologic<br>System in Northwestern Colorado,<br>W83-00168   |
| <b>SCIENCE AND EDUCATION<br/>ADMINISTRATION, TUCSON, AZ.</b>   |    | <b>STRASBOURG-1 (FRANCE).</b>   |    | <b>4C</b>   |
| Sediment Yield from Small Semiarid Rangeland<br>Watersheds,<br>W83-00105   | 4D | Measurement and Mapping of Potential Evapo-<br>transpiration in a Small Mountainous Watershed,<br>W83-00346   | 2D | <b>TUFTS UNIV., MEDFORD, MA.; AND<br/>NATIONAL COUNCIL FOR AIR AND<br/>STREAM IMPROVEMENT, INC., MEDFORD,<br/>MA.</b>                           |
| <b>SCIENCE AND EDUCATION<br/>ADMINISTRATION, TUCSON, AZ.<br/>SOUTHWEST RANGELAND WATERSHED<br/>RESEARCH CENTER.</b>                  |    | <b>SULZER BROS. LTD., WINTERTHUR<br/>(SWITZERLAND).</b>   |    | Pulp and Paper Effluent Management,<br>W83-00164  |
| The USLE Rainfall Factor for Southwestern U.<br>S. Rangelands,<br>W83-00098  | 4D | Wastewater Flocculation-Filtration and Post<br>Disinfection,<br>W83-00239   | 5D | <b>5D</b>   |
| Modeling Erosion in Overland Flow,<br>W83-00104  | 4D | <b>TAYLOR (JOHN) AND SONS, LONDON<br/>(ENGLAND).</b>  |    | <b>UNIVERSITAET DES SAARLANDES,<br/>SAARBRUECKEN (GERMANY, F.R.). DEPT.<br/>OF MICROBIOLOGY.</b>  |
| <b>SEVERN-TRENT WATER AUTHORITY,<br/>BIRMINGHAM (ENGLAND). DIRECTORATE<br/>OF SCIENTIFIC SERVICES.</b>                               |    | Instrumental Methods of Monitoring and Con-<br>trol of Water and Wastewater Treatment Pro-<br>cesses,<br>W83-00314  | 5F | The Sediments of the New Artificial Lake Bos-<br>taisse (Saarland, Germany), with Particular Ref-<br>erence to Microbial Activity,<br>W83-00048 |
| Chemical Surveillance of Rivers,<br>W83-00134  | 5A | <b>TENNESSEE VALLEY AUTHORITY,<br/>KNOXVILLE, TN.</b>   |    | <b>5C</b>   |
|  |    | Municipal Point Source and Agricultural Non-<br>point Source Contribution to Coastal Eutrophi-<br>cation,<br>W83-00001                                      | 5B | <b>UNIVERSITY COLL. OF SWANSEA (WALES).<br/>CENTRE FOR DEVELOPMENT STUDIES.</b>   |
|  |    |   |    | Irrigation Planning in the Tana Basin of Kenya,<br>W83-00015  |
|  |    |   |    | <b>6B</b>   |
|  |    |   |    | <b>UNIVERSITY OF SCIENCE AND<br/>TECHNOLOGY, KUMASI (GHANA). DEPT.<br/>OF BIOLOGICAL SCIENCES.</b>  |
|  |    |   |    | Diel Periodicity in the Chemical Composition of<br>Lake Phytoplankton,<br>W83-00049   |
|  |    |   |    | <b>5B</b>   |
|  |    |   |    | <b>UNIVERSITY OF THE WITWATERSRAND,<br/>JOHANNESBURG (SOUTH AFRICA). DEPT.<br/>OF CONSTRUCTION MATERIALS.</b>                                   |
|  |    |   |    | The Flow of Slurry from a Breached Tailings<br>Dam,<br>W83-00285  |
|  |    |   |    | <b>8B</b>   |
|  |    |   |    | <b>UNIVERSITY OF THE WITWATERSRAND,<br/>JOHANNESBURG (SOUTH AFRICA).<br/>HYDROLOGICAL RESEARCH UNIT.</b>  |
|  |    |   |    | A Depth-Duration-Frequency Diagram for<br>Point Rainfall in Swa-Namibia,<br>W83-00289   |
|  |    |   |    | <b>2B</b>   |

## ORGANIZATIONAL INDEX

### UPPSALA UNIV. (SWEDEN). DEPT. OF ENTOMOLOGY.

#### UPPSALA UNIV. (SWEDEN). DEPT. OF ENTOMOLOGY.

Paleoecological Studies of the Recent Development of the Lake Vaxjösjön. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,  
W83-00028

5C

#### UPPSALA UNIV. (SWEDEN). INST. LIMNOLOGY.

Characterization of Acid Phosphatases in the Acidified Lake Gardsjön, Sweden,  
W83-00050

5C

#### UPPSALA UNIV. (SWEDEN). INST. OF LIMNOLOGY.

Induction of High Phosphatase Activity by Aluminum in Acid Lakes,  
W83-00029

5B

#### UTAH STATE UNIV., LOGAN. WATERSHED SCIENCE UNIT.

A Test of the USLE on Bare and Sagebrush Plots in Utah,  
W83-00101

4D

#### UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS). ANALYTICAL CHEMISTRY LAB.

Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,  
W83-00046

5A

#### VIRGINIA COMMONWEALTH UNIV., RICHMOND. DEPT. OF BIOLOGY.

Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,  
W83-00044

2H

#### VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.

Water Law Primer,  
W83-00318

6E

#### VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF ENVIRONMENTAL SCIENCES.

The Ecology of the Mangroves of South Florida: A Community Profile,  
W83-00093

6G

#### VIRGINIA WATER RESOURCES CENTER, BLACKSBURG.

Law,  
W83-00165

6E

#### WASHINGTON STATE UNIV., PULLMAN.

Effects of Slope Length and Steepness on Soil Erosion from Rangelands,  
W83-00099

2J

#### WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING.

Reservoir Management in Potomac River Basin,  
W83-00203

6A

Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,  
W83-00229

3D

#### WATER RESEARCH CENTRE (ENGLAND).

The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,  
W83-00220

5E

#### WATER RESEARCH CENTRE, MARLOW (ENGLAND).

Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme.  
W83-00196

5A

#### WAYNE COUNTY DEPT. OF PUBLIC WORKS, WYANDOTTE, MI.

Recycling of Mercury and Silver from COD Tests,  
W83-00145

5D

#### WESSEX WATER AUTHORITY, BRISTOL (ENGLAND). AVON AND DORSET RECOVERY DIV.

The Use of Oxygen to Upgrade the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,  
W83-00133

5D

#### WESTON (ROY F.), INC., WEST CHESTER, PA.

Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,  
W83-00291

5D

#### WHITE (R. H.) CONSTRUCTION CO., INC., AUBURN, MA.

Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View,  
W83-00136

5F

#### WISCONSIN UNIV.-MILWAUKEE. DEPT. OF CIVIL ENGINEERING.

Wastewater Management Problems in Rural Communities,  
W83-00249

5G

#### WYOMING UNIV., LARAMIE. WATER RESOURCES, RESEARCH INST.

Evaluation of Limnological Parameters as Related to the Success of *Mysis relicta* Introductions,  
W83-00254

8I

#### INSTREAM SALMONID HABITAT EXCLUSION BY ICE-COVER.

W83-00257

8I

#### ZULULAND UNIV. (SOUTH AFRICA). DEPT. OF BOTANY.

The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,  
W83-00036

2H

#### ZURICH UNIV. (SWITZERLAND). HYDROBIOLOGICAL-LIMNOLOGICAL STATION.

Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,  
W83-00034

2H

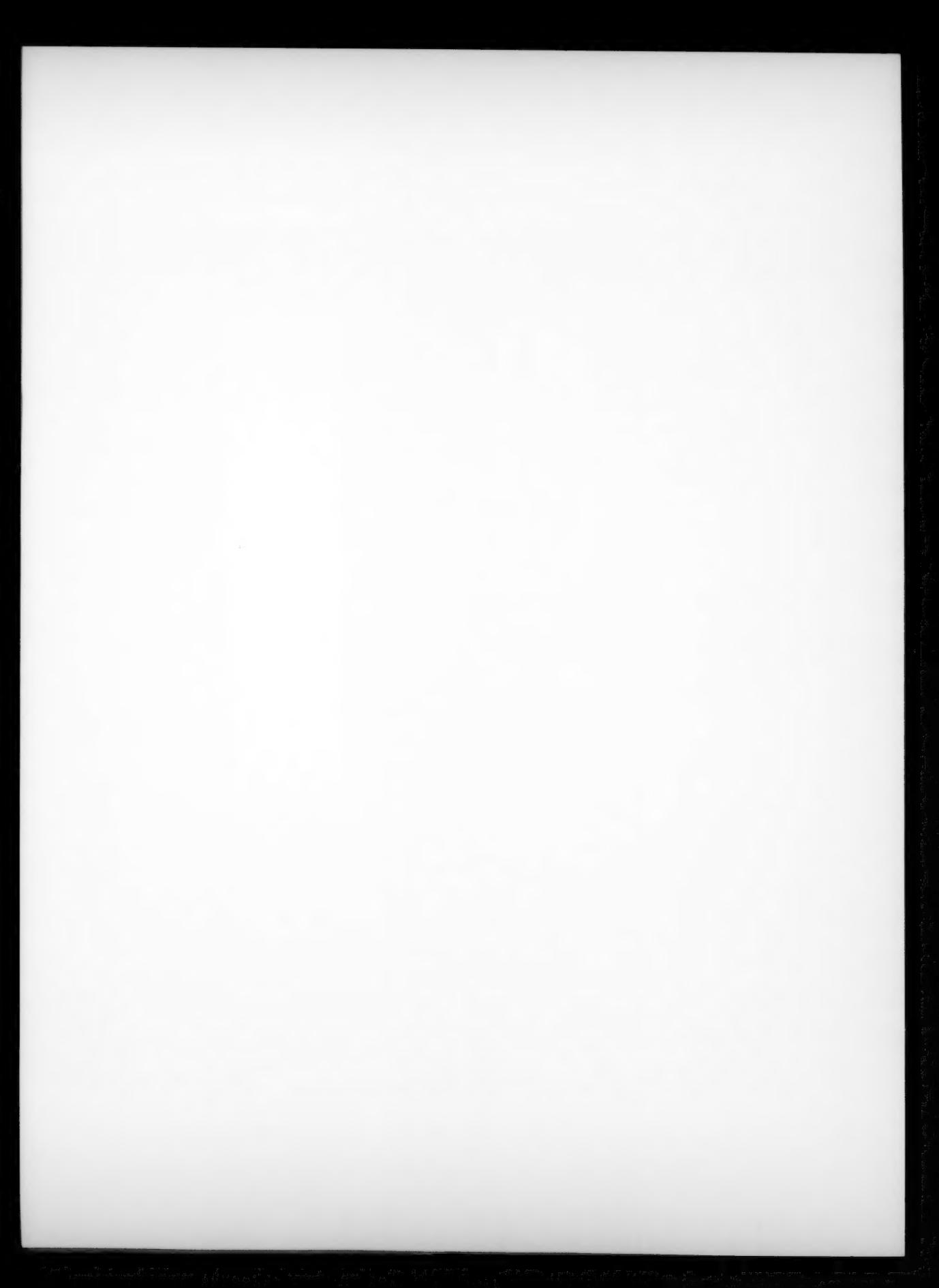
## ACCESSION NUMBER INDEX

|           |    |           |    |           |    |           |     |
|-----------|----|-----------|----|-----------|----|-----------|-----|
| W83-00001 | 5B | W83-00085 | 4A | W83-00169 | 5B | W83-00253 | 6B  |
| W83-00002 | 5B | W83-00086 | 5D | W83-00170 | 5F | W83-00254 | 8I  |
| W83-00003 | 5G | W83-00087 | 4D | W83-00171 | 5F | W83-00255 | 8I  |
| W83-00004 | 6D | W83-00088 | 2B | W83-00172 | 5F | W83-00256 | 3A  |
| W83-00005 | 6B | W83-00089 | 2E | W83-00173 | 5B | W83-00257 | 8I  |
| W83-00006 | 5C | W83-00090 | 5G | W83-00174 | 5B | W83-00258 | 5G  |
| W83-00007 | 4A | W83-00091 | 5F | W83-00175 | 8G | W83-00259 | 3A  |
| W83-00008 | 8G | W83-00092 | 5D | W83-00176 | 2B | W83-00260 | 3A  |
| W83-00009 | 5C | W83-00093 | 6G | W83-00177 | 5D | W83-00261 | 3A  |
| W83-00010 | 6G | W83-00094 | 8G | W83-00178 | 5C | W83-00262 | 7C  |
| W83-00011 | 6A | W83-00095 | 7C | W83-00179 | 5D | W83-00263 | 5C  |
| W83-00012 | 5B | W83-00096 | 2J | W83-00180 | 5G | W83-00264 | 5B  |
| W83-00013 | 5D | W83-00097 | 2J | W83-00181 | 5D | W83-00265 | 3F  |
| W83-00014 | 5A | W83-00098 | 4D | W83-00182 | 5A | W83-00266 | 5G  |
| W83-00015 | 6B | W83-00099 | 2J | W83-00183 | 5C | W83-00267 | 3A  |
| W83-00016 | 6A | W83-00100 | 2J | W83-00184 | 5B | W83-00268 | 8C  |
| W83-00017 | 6D | W83-00101 | 4D | W83-00185 | 5D | W83-00269 | 2E  |
| W83-00018 | 5C | W83-00102 | 2J | W83-00186 | 6B | W83-00270 | 3A  |
| W83-00019 | 5B | W83-00103 | 2J | W83-00187 | 5B | W83-00271 | 5B  |
| W83-00020 | 5F | W83-00104 | 4D | W83-00188 | 3F | W83-00272 | 4A  |
| W83-00021 | 5C | W83-00105 | 4D | W83-00189 | 5C | W83-00273 | 10D |
| W83-00022 | 5C | W83-00106 | 4D | W83-00190 | 5C | W83-00274 | 10D |
| W83-00023 | 5G | W83-00107 | 4D | W83-00191 | 5D | W83-00275 | 2F  |
| W83-00024 | 5G | W83-00108 | 4D | W83-00192 | 5D | W83-00276 | 5E  |
| W83-00025 | 5C | W83-00109 | 4B | W83-00193 | 6G | W83-00277 | 5G  |
| W83-00026 | 5C | W83-00110 | 7C | W83-00194 | 5A | W83-00278 | 3F  |
| W83-00027 | 2H | W83-00111 | 4D | W83-00195 | 5A | W83-00279 | 2D  |
| W83-00028 | 5C | W83-00112 | 2K | W83-00196 | 5A | W83-00280 | 5F  |
| W83-00029 | 5B | W83-00113 | 7C | W83-00197 | 5F | W83-00281 | 5G  |
| W83-00030 | 5C | W83-00114 | 4B | W83-00198 | 5F | W83-00282 | 2E  |
| W83-00031 | 2H | W83-00115 | 7C | W83-00199 | 5F | W83-00283 | 5F  |
| W83-00032 | 5B | W83-00116 | 7C | W83-00200 | 5G | W83-00284 | 5D  |
| W83-00033 | 2H | W83-00117 | 7C | W83-00201 | 6E | W83-00285 | 8B  |
| W83-00034 | 2H | W83-00118 | 2C | W83-00202 | 5A | W83-00286 | 2G  |
| W83-00035 | 2L | W83-00119 | 2C | W83-00203 | 6A | W83-00287 | 2D  |
| W83-00036 | 2H | W83-00120 | 4B | W83-00204 | 5A | W83-00288 | 5C  |
| W83-00037 | 2H | W83-00121 | 4D | W83-00205 | 8G | W83-00289 | 2B  |
| W83-00038 | 5B | W83-00122 | 4A | W83-00206 | 8C | W83-00290 | 5A  |
| W83-00039 | 5B | W83-00123 | 4A | W83-00207 | 8A | W83-00291 | 5D  |
| W83-00040 | 2H | W83-00124 | 5A | W83-00208 | 5C | W83-00292 | 5A  |
| W83-00041 | 2H | W83-00125 | 2F | W83-00209 | 6E | W83-00293 | 5F  |
| W83-00042 | 5C | W83-00126 | 5B | W83-00210 | 5G | W83-00294 | 5B  |
| W83-00043 | 5C | W83-00127 | 2K | W83-00211 | 5B | W83-00295 | 5C  |
| W83-00044 | 2H | W83-00128 | 4A | W83-00212 | 5D | W83-00296 | 5E  |
| W83-00045 | 5A | W83-00129 | 5B | W83-00213 | 5A | W83-00297 | 6G  |
| W83-00046 | 5A | W83-00130 | 4B | W83-00214 | 5B | W83-00298 | 5E  |
| W83-00047 | 5A | W83-00131 | 7C | W83-00215 | 5G | W83-00299 | 3B  |
| W83-00048 | 5C | W83-00132 | 7C | W83-00216 | 6B | W83-00300 | 5B  |
| W83-00049 | 5B | W83-00133 | 5D | W83-00217 | 4B | W83-00301 | 4D  |
| W83-00050 | 5C | W83-00134 | 5A | W83-00218 | 4D | W83-00302 | 4D  |
| W83-00051 | 5B | W83-00135 | 5F | W83-00219 | 5B | W83-00303 | 3B  |
| W83-00052 | 5C | W83-00136 | 5F | W83-00220 | 5E | W83-00304 | 5B  |
| W83-00053 | 5C | W83-00137 | 5G | W83-00221 | 5D | W83-00305 | 2J  |
| W83-00054 | 5C | W83-00138 | 5D | W83-00222 | 3A | W83-00306 | 6B  |
| W83-00055 | 5C | W83-00139 | 5B | W83-00223 | 6G | W83-00307 | 2I  |
| W83-00056 | 5B | W83-00140 | 2J | W83-00224 | 5B | W83-00308 | 6B  |
| W83-00057 | 7C | W83-00141 | 5C | W83-00225 | 4B | W83-00309 | 3F  |
| W83-00058 | 7C | W83-00142 | 5D | W83-00226 | 5D | W83-00310 | 3F  |
| W83-00059 | 7C | W83-00143 | 5D | W83-00227 | 5C | W83-00311 | 3F  |
| W83-00060 | 4B | W83-00144 | 5C | W83-00228 | 5B | W83-00312 | 4A  |
| W83-00061 | 7C | W83-00145 | 5D | W83-00229 | 3D | W83-00313 | 8C  |
| W83-00062 | 4C | W83-00146 | 5A | W83-00230 | 3F | W83-00314 | 5F  |
| W83-00063 | 4A | W83-00147 | 5G | W83-00231 | 5A | W83-00315 | 5G  |
| W83-00064 | 5B | W83-00148 | 5G | W83-00232 | 5D | W83-00316 | 2H  |
| W83-00065 | 7B | W83-00149 | 5D | W83-00233 | 5E | W83-00317 | 5D  |
| W83-00066 | 5B | W83-00150 | 5D | W83-00234 | 3F | W83-00318 | 6E  |
| W83-00067 | 2E | W83-00151 | 5D | W83-00235 | 3F | W83-00319 | 5D  |
| W83-00068 | 5B | W83-00152 | 5D | W83-00236 | 5E | W83-00320 | 5G  |
| W83-00069 | 7C | W83-00153 | 5C | W83-00237 | 7C | W83-00321 | 7A  |
| W83-00070 | 2E | W83-00154 | 5D | W83-00238 | 5B | W83-00322 | 5G  |
| W83-00071 | 2E | W83-00155 | 5G | W83-00239 | 5D | W83-00323 | 2K  |
| W83-00072 | 5B | W83-00156 | 5D | W83-00240 | 6B | W83-00324 | 5G  |
| W83-00073 | 7A | W83-00157 | 5D | W83-00241 | 6A | W83-00325 | 5D  |
| W83-00074 | 7C | W83-00158 | 5A | W83-00242 | 3F | W83-00326 | 5D  |
| W83-00075 | 7C | W83-00159 | 5C | W83-00243 | 5D | W83-00327 | 5D  |
| W83-00076 | 7C | W83-00160 | 5B | W83-00244 | 3A | W83-00328 | 5D  |
| W83-00077 | 7C | W83-00161 | 5A | W83-00245 | 5G | W83-00329 | 2H  |
| W83-00078 | 7C | W83-00162 | 5G | W83-00246 | 3A | W83-00330 | 5B  |
| W83-00079 | 5G | W83-00163 | 5D | W83-00247 | 5G | W83-00331 | 5C  |
| W83-00080 | 5D | W83-00164 | 5D | W83-00248 | 4A | W83-00332 | 5B  |
| W83-00081 | 7B | W83-00165 | 6E | W83-00249 | 5G | W83-00333 | 5C  |
| W83-00082 | 3E | W83-00166 | 4A | W83-00250 | 6E | W83-00334 | 8A  |
| W83-00083 | 5D | W83-00167 | 5G | W83-00251 | 2E | W83-00335 | 5F  |
| W83-00084 | 2B | W83-00168 | 4C | W83-00252 | 5G | W83-00336 | 8G  |

ACCESSION NUMBER INDEX

W83-00337

W83-00337 5D  
W83-00338 8C  
W83-00339 8A  
W83-00340 8C  
W83-00341 5F  
W83-00342 5F  
W83-00343 5C  
W83-00344 2H  
W83-00345 2H  
W83-00346 2D  
W83-00347 2A  
W83-00348 5A  
W83-00349 5D  
W83-00350 5D



## Subject Fields

### 1 NATURE OF WATER

### 2 WATER CYCLE

### 3 WATER SUPPLY AUGMENTATION AND CONSERVATION

### 4 WATER QUANTITY MANAGEMENT AND CONTROL

### 5 WATER QUALITY MANAGEMENT AND PROTECTION

### 6 WATER RESOURCES PLANNING

### 7 RESOURCES DATA

### 8 ENGINEERING WORKS

### 9 MANPOWER, GRANTS, AND FACILITIES

### 10 SCIENTIFIC AND TECHNICAL INFORMATION

## INDEXES

### SUBJECT INDEX

### AUTHOR INDEX

### ORGANIZATIONAL INDEX

### ACCESSION NUMBER INDEX

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